



US009707119B2

(12) **United States Patent**  
**Berns et al.**

(10) **Patent No.:** **US 9,707,119 B2**

(45) **Date of Patent:** **Jul. 18, 2017**

(54) **FOOT SUPPORT ARTICLE**

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(\*) Notice: Subject to any disclaimer, the term of this  
patent is extended or adjusted under 35  
U.S.C. 154(b) by 0 days.

(21) Appl. No.: **14/013,684**

(22) Filed: **Aug. 29, 2013**

(65) **Prior Publication Data**

US 2014/0005585 A1 Jan. 2, 2014

**Related U.S. Application Data**

(60) Division of application No. 13/157,023, filed on Jun.  
9, 2011, now Pat. No. 9,402,437, which is a  
(Continued)

(51) **Int. Cl.**  
**A43B 7/14** (2006.01)  
**A43B 7/20** (2006.01)

(Continued)

(52) **U.S. Cl.**  
CPC ..... **A61F 5/0127** (2013.01); **A43B 7/14**  
(2013.01); **A43B 7/20** (2013.01); **A61F 5/0111**  
(2013.01);

(Continued)

(58) **Field of Classification Search**

CPC .... **A61F 5/0111**; **A61F 5/0127**; **A61F 13/066**;  
**A61F 13/62**; **A61F 13/622**; **A43B 7/14**;  
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*Primary Examiner* — Clinton T Ostrup

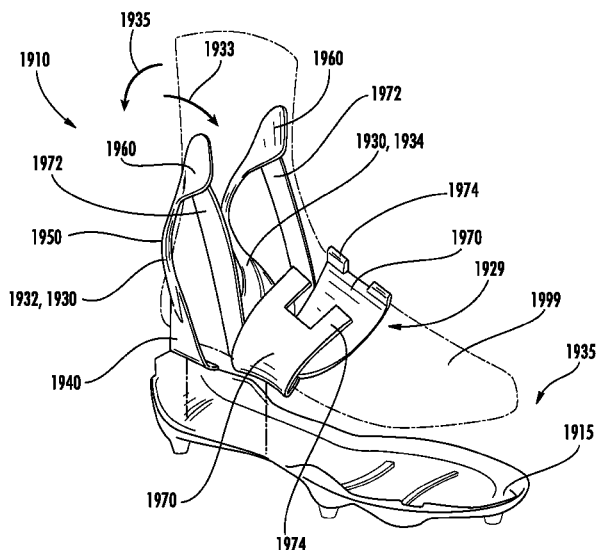
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(57) **ABSTRACT**

An article of footwear includes a sole, an upper defining a foot cavity, and a brace member. The brace member is comprised of a non-elastic resilient material. The brace member is positioned within a pocket in the upper and extends from a heel portion to above an ankle portion of the upper. The brace member may be provided with a top plate member and a base plate member with a central shaft extending between the top plate member and the base plate member. The central shaft may have a C-shape that curves around an ankle of a human foot positioned within the foot cavity.

**26 Claims, 26 Drawing Sheets**



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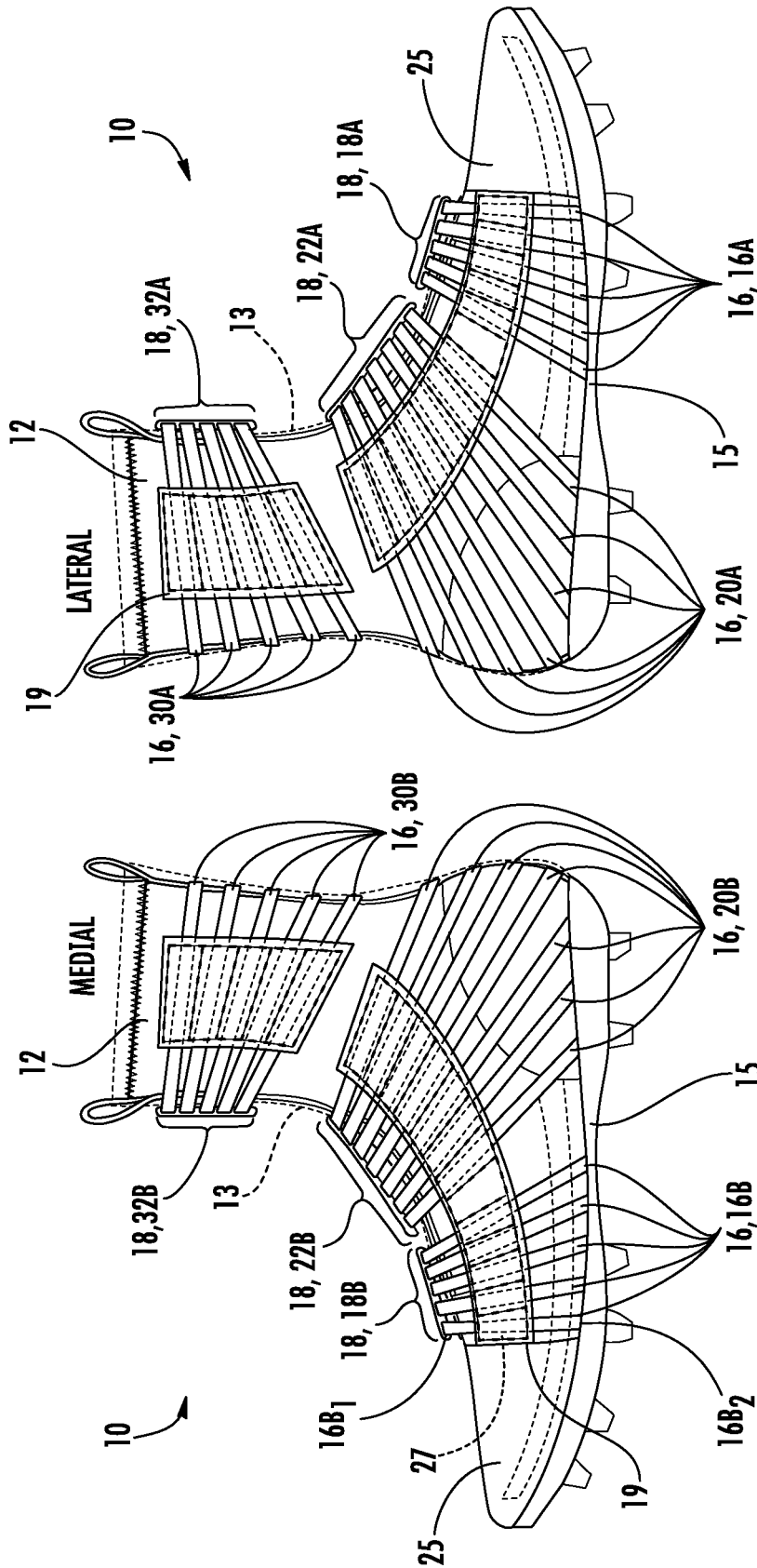
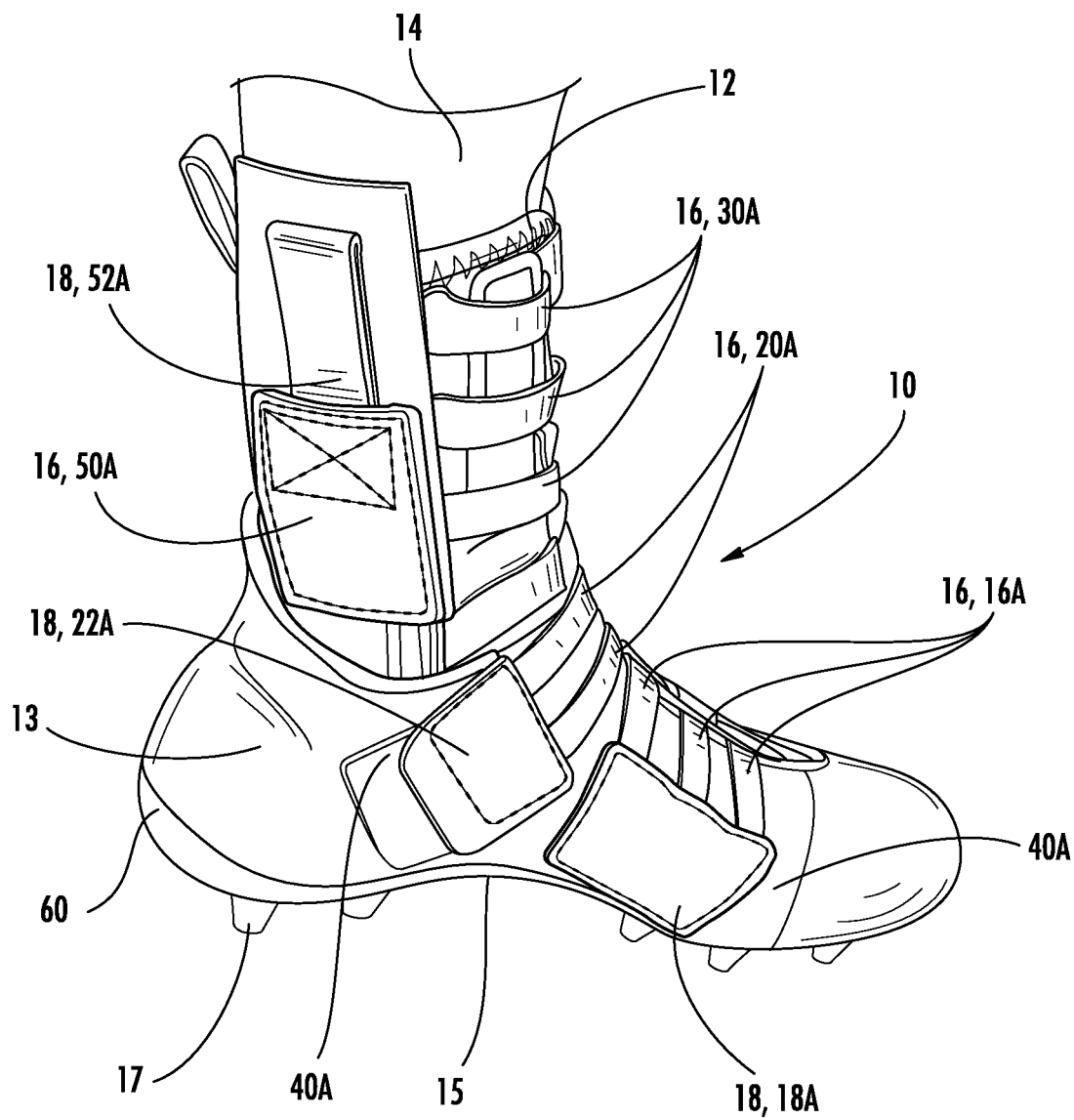


FIG. 1A

FIG. 1B



**FIG. 2A**

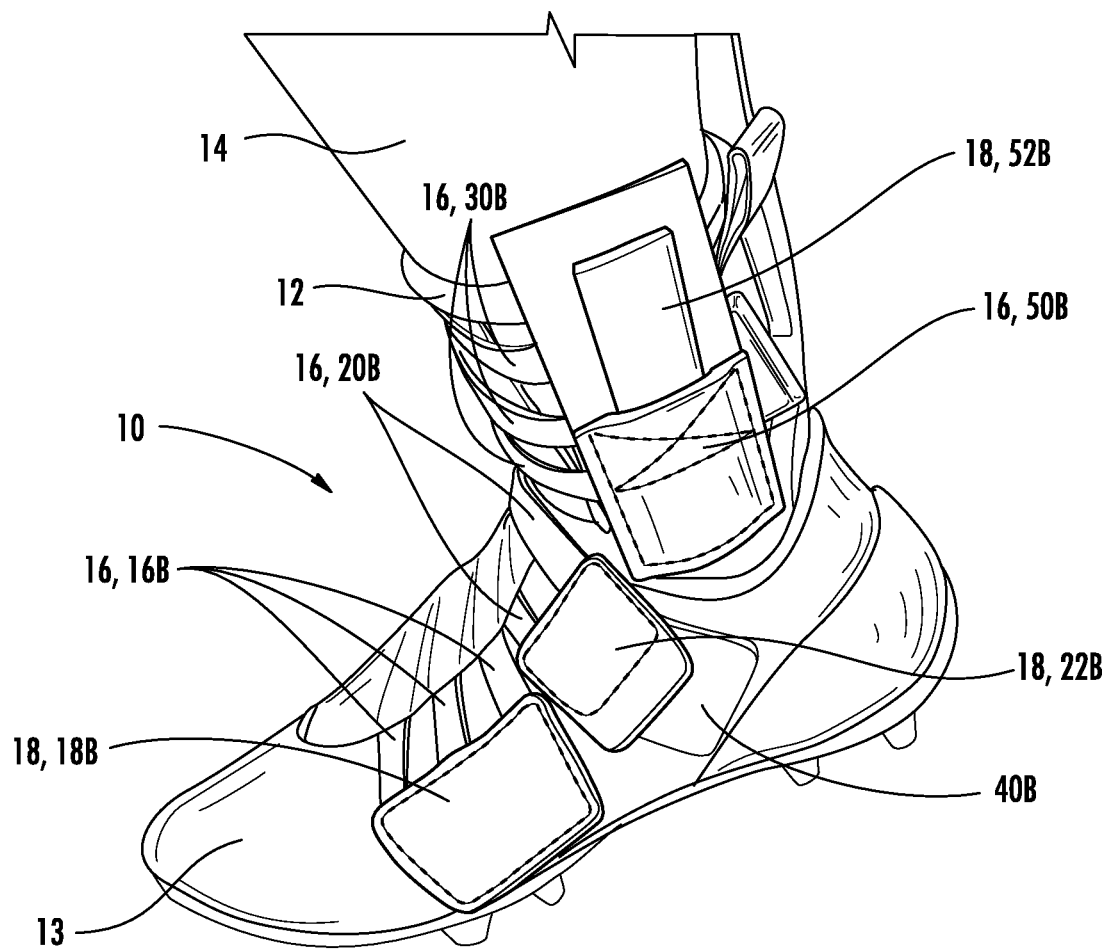


FIG. 2B

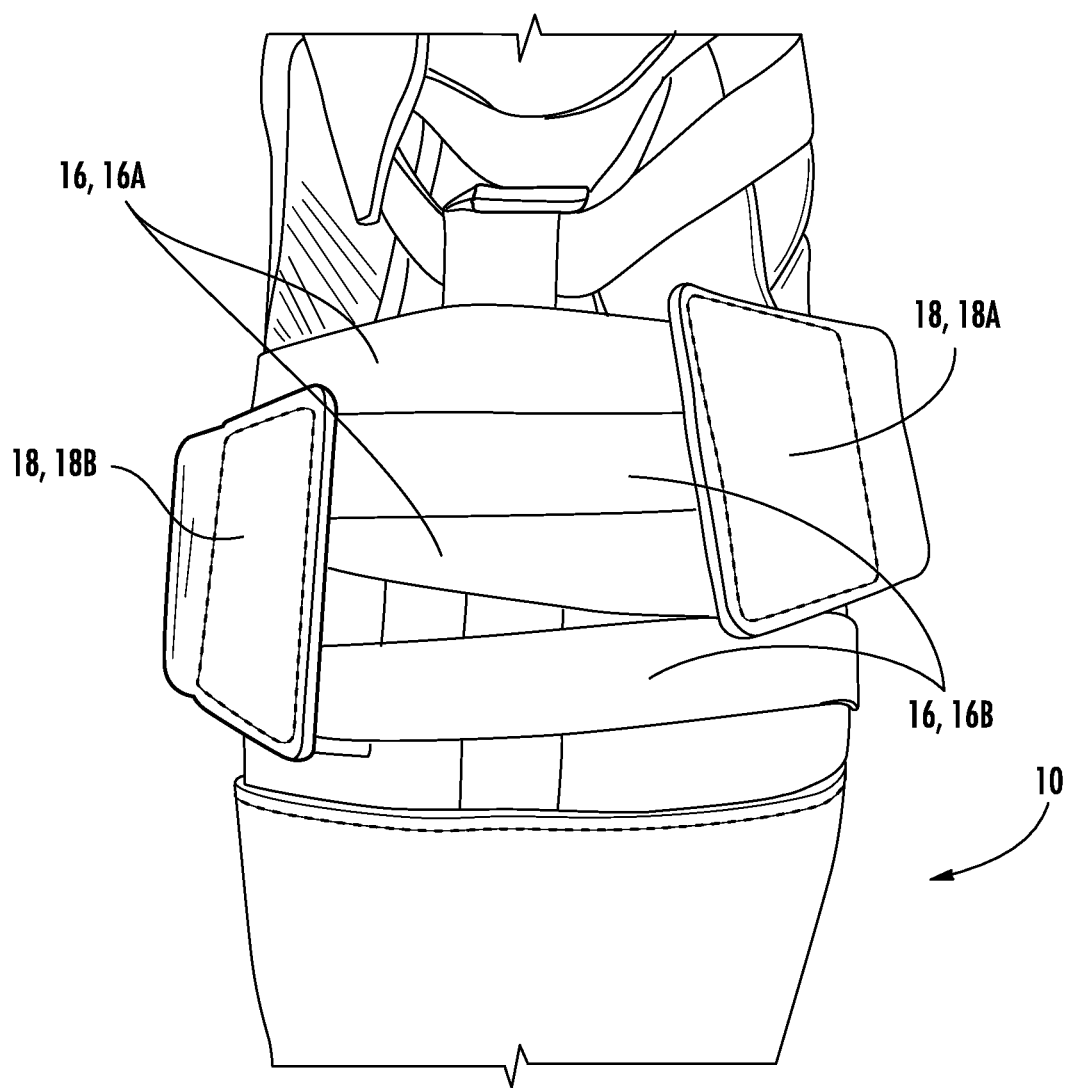
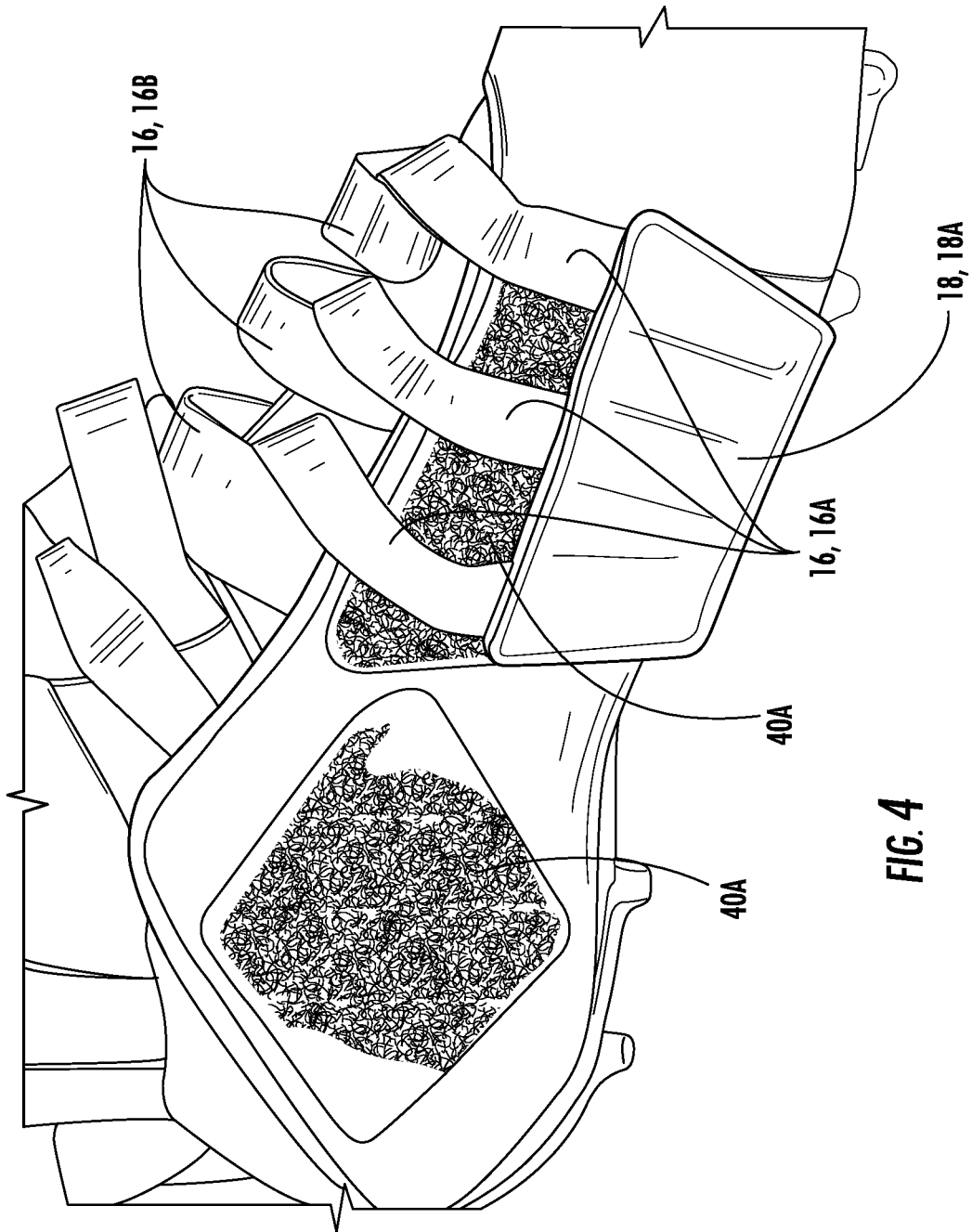


FIG. 3





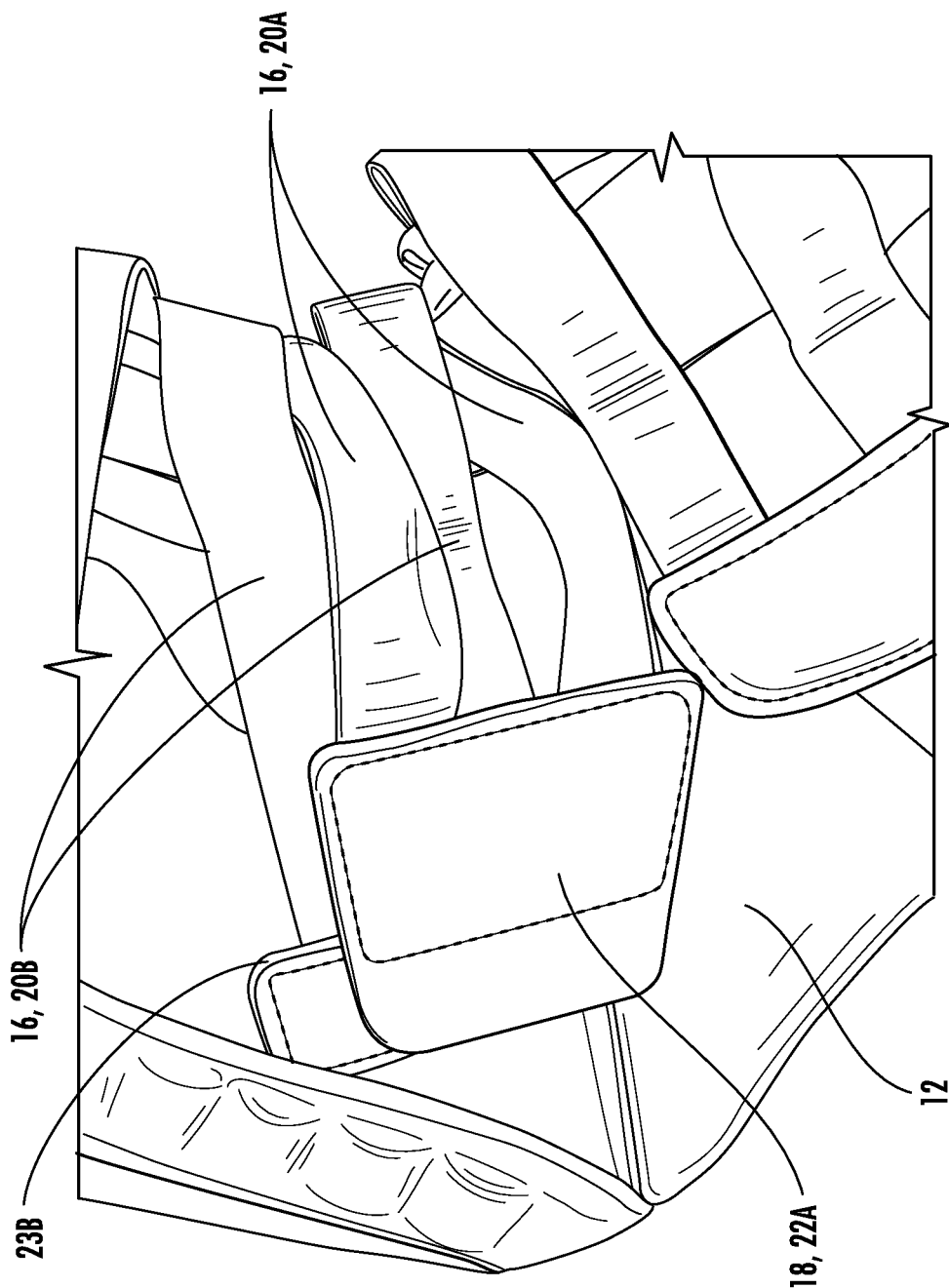
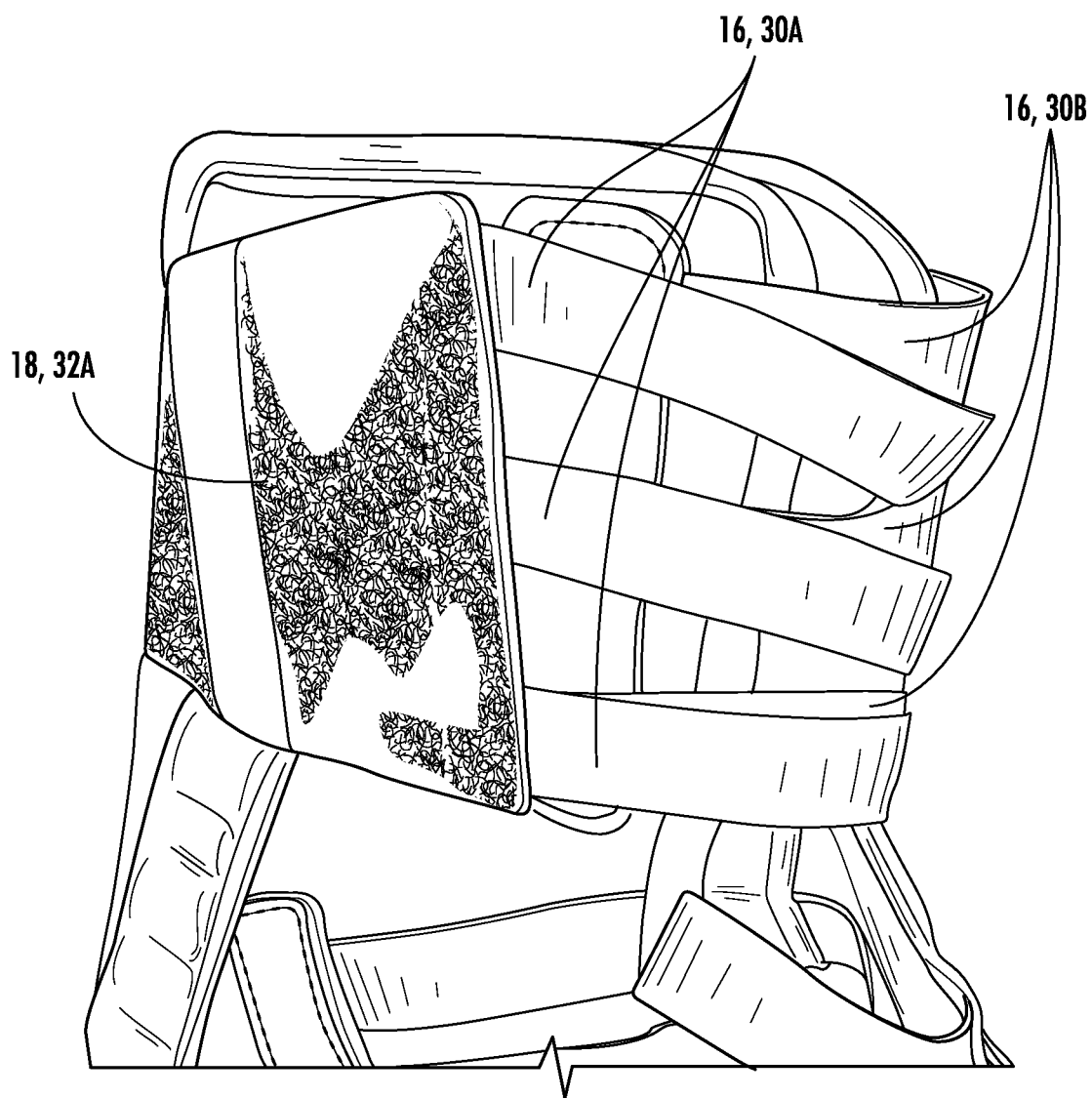
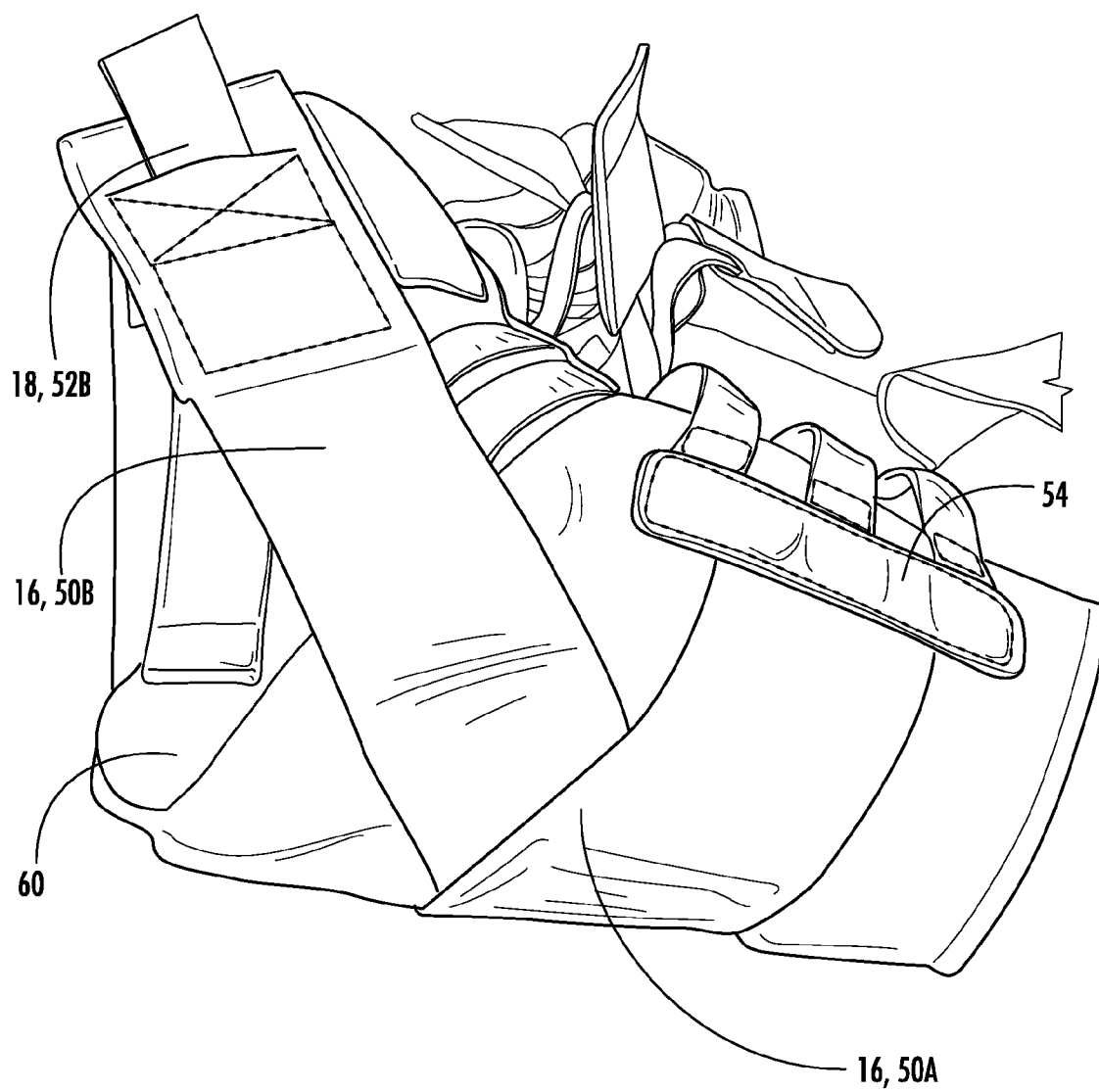


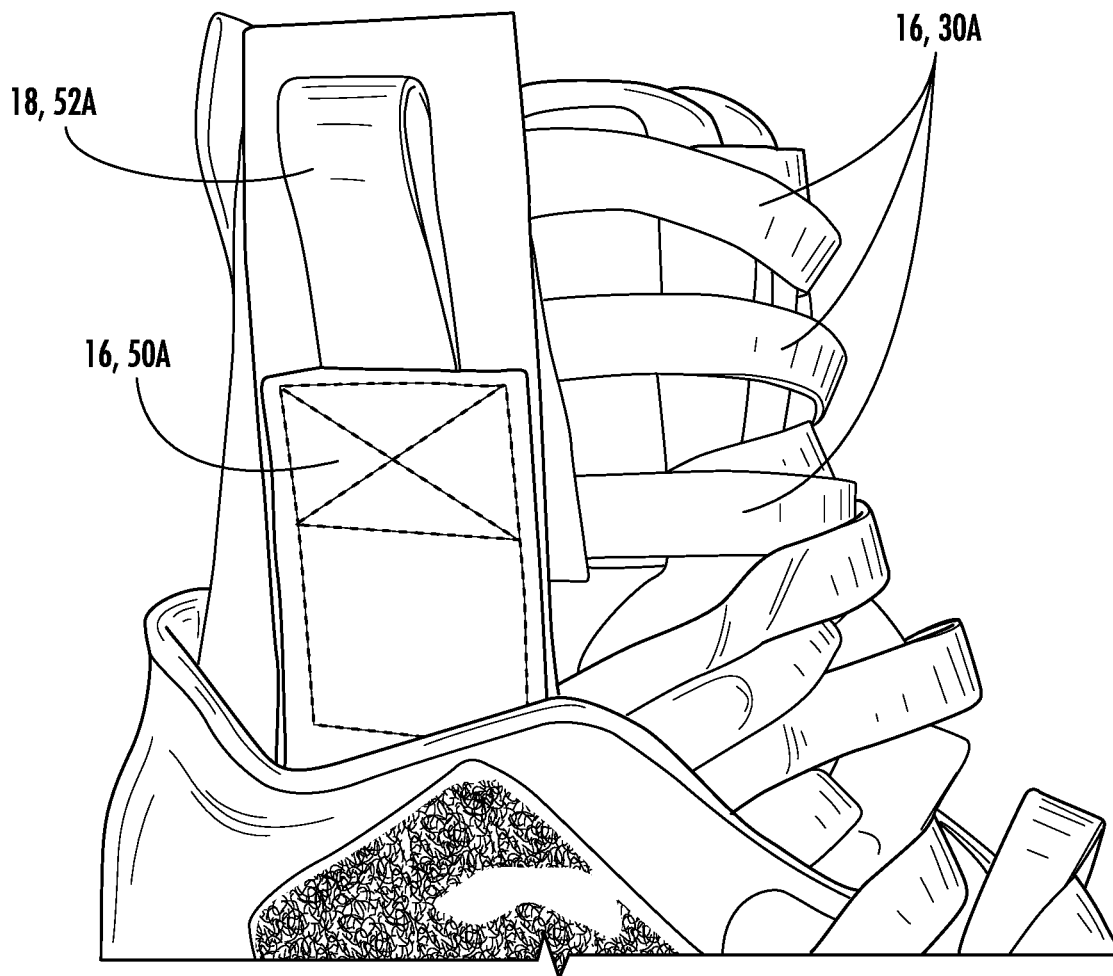
FIG. 5



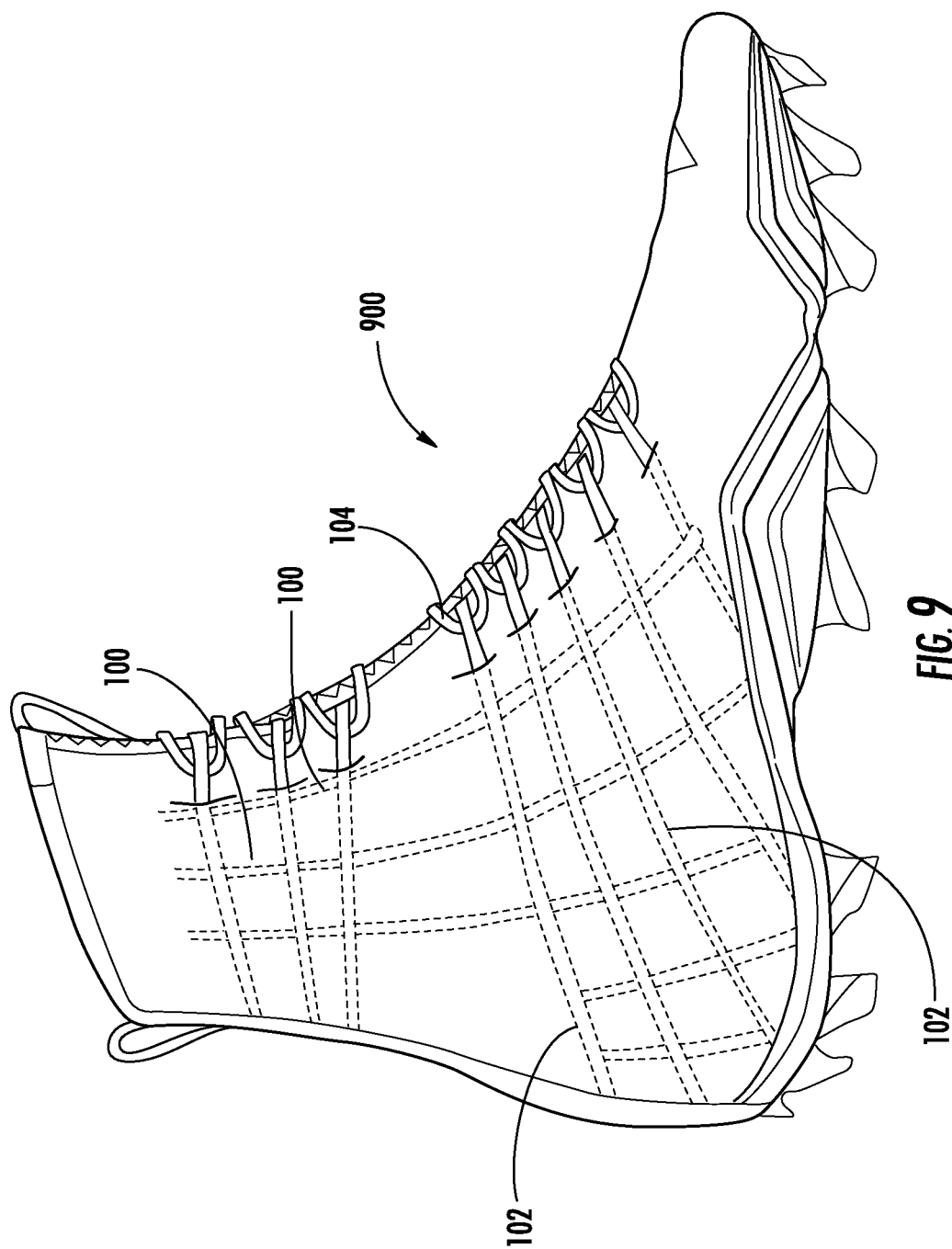
**FIG. 6**



**FIG. 7**



**FIG. 8**



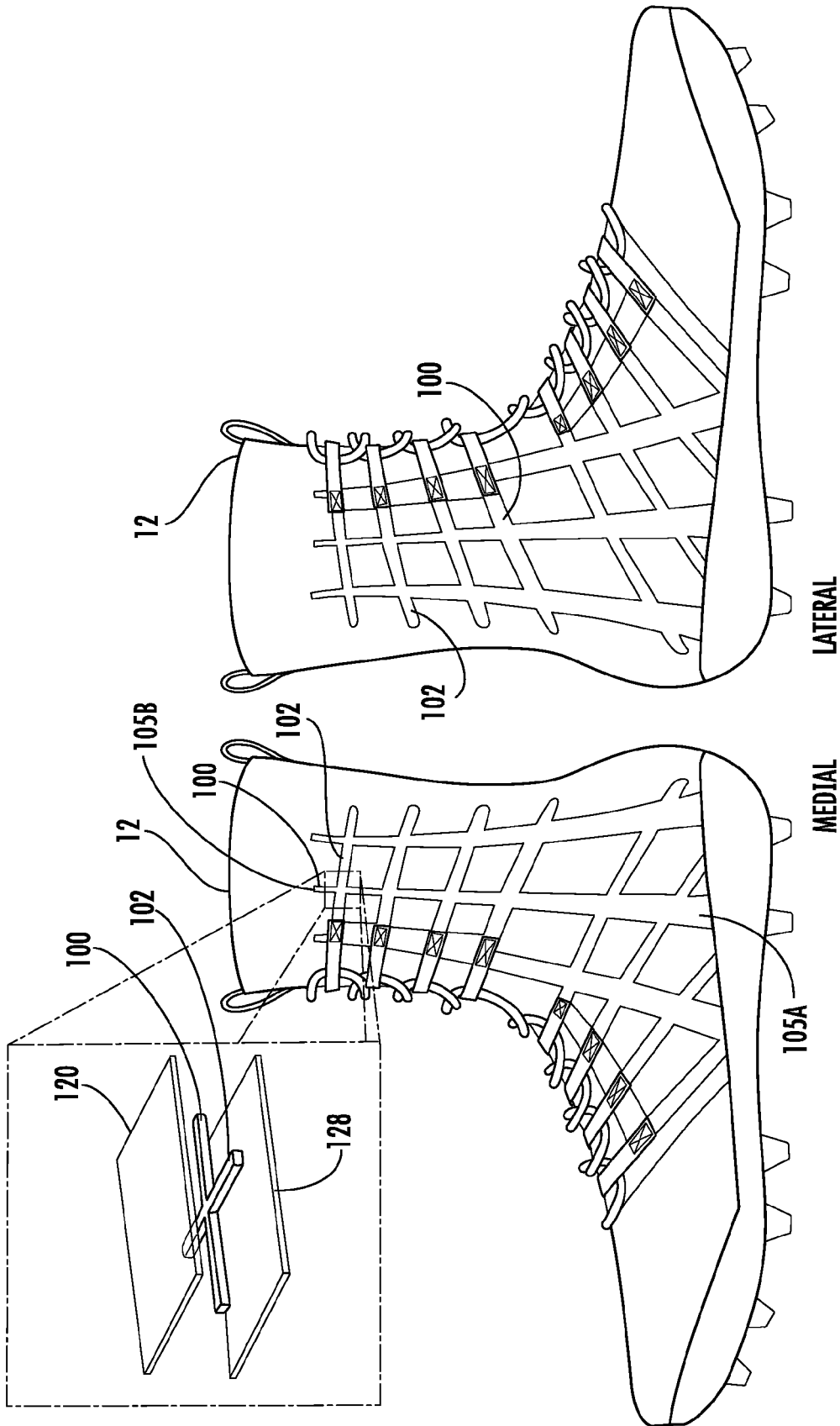
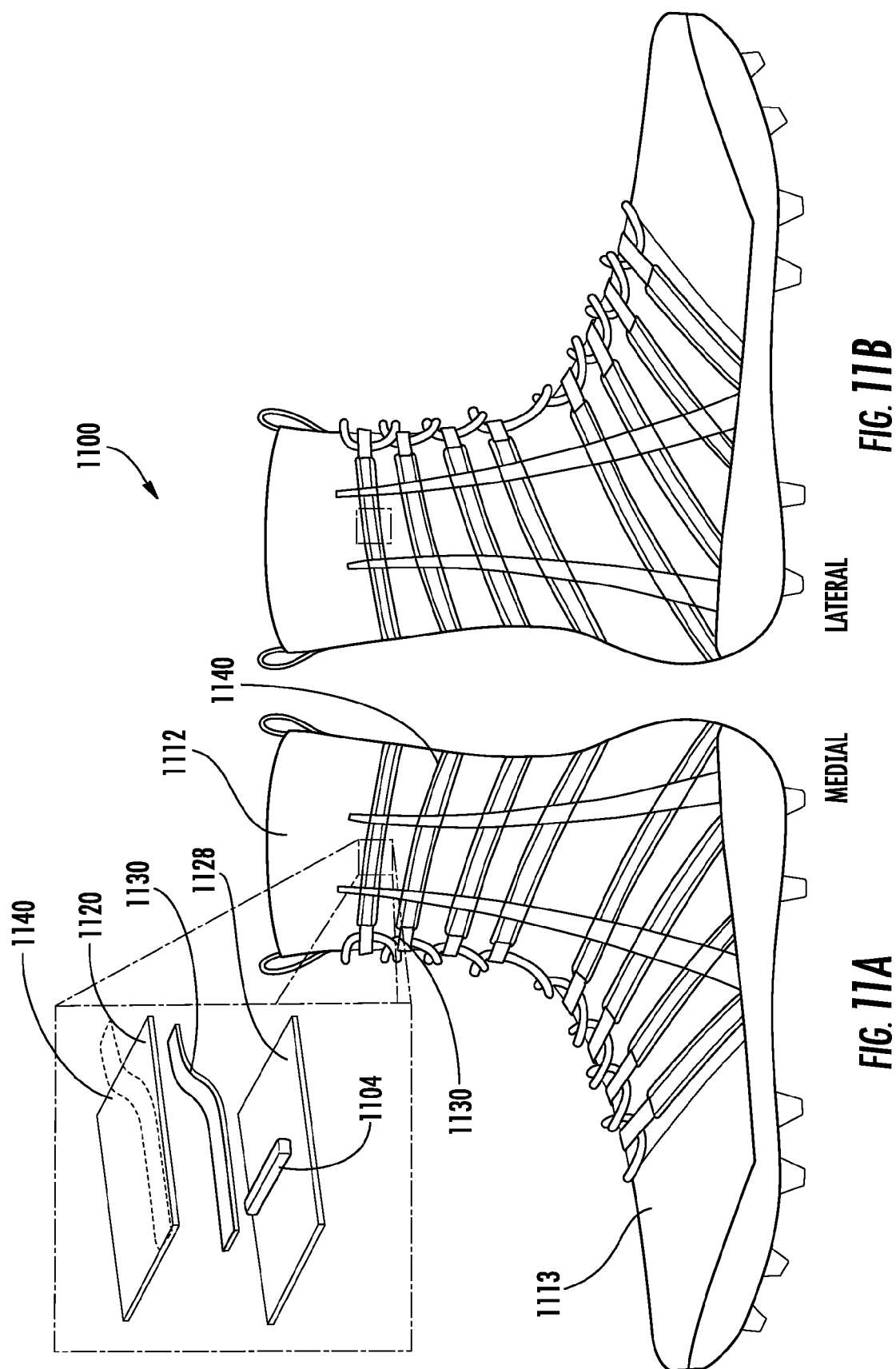
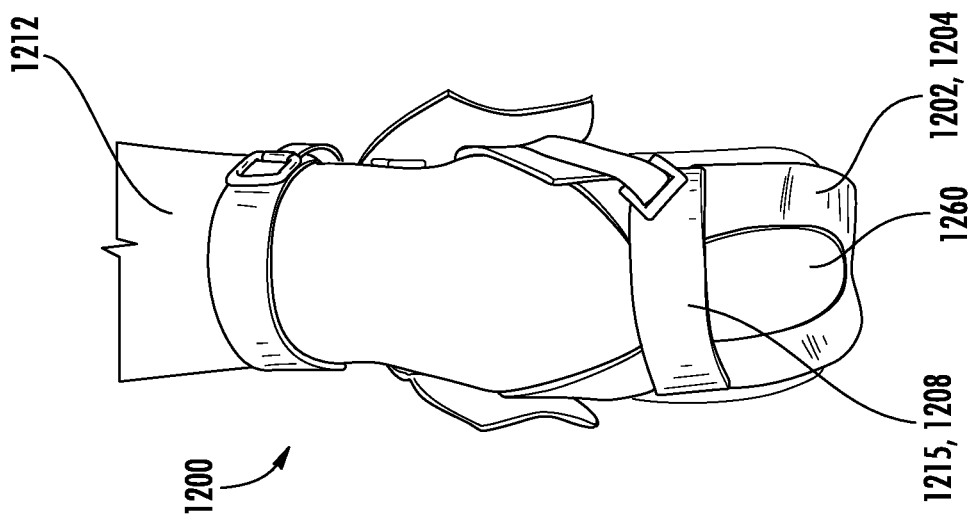


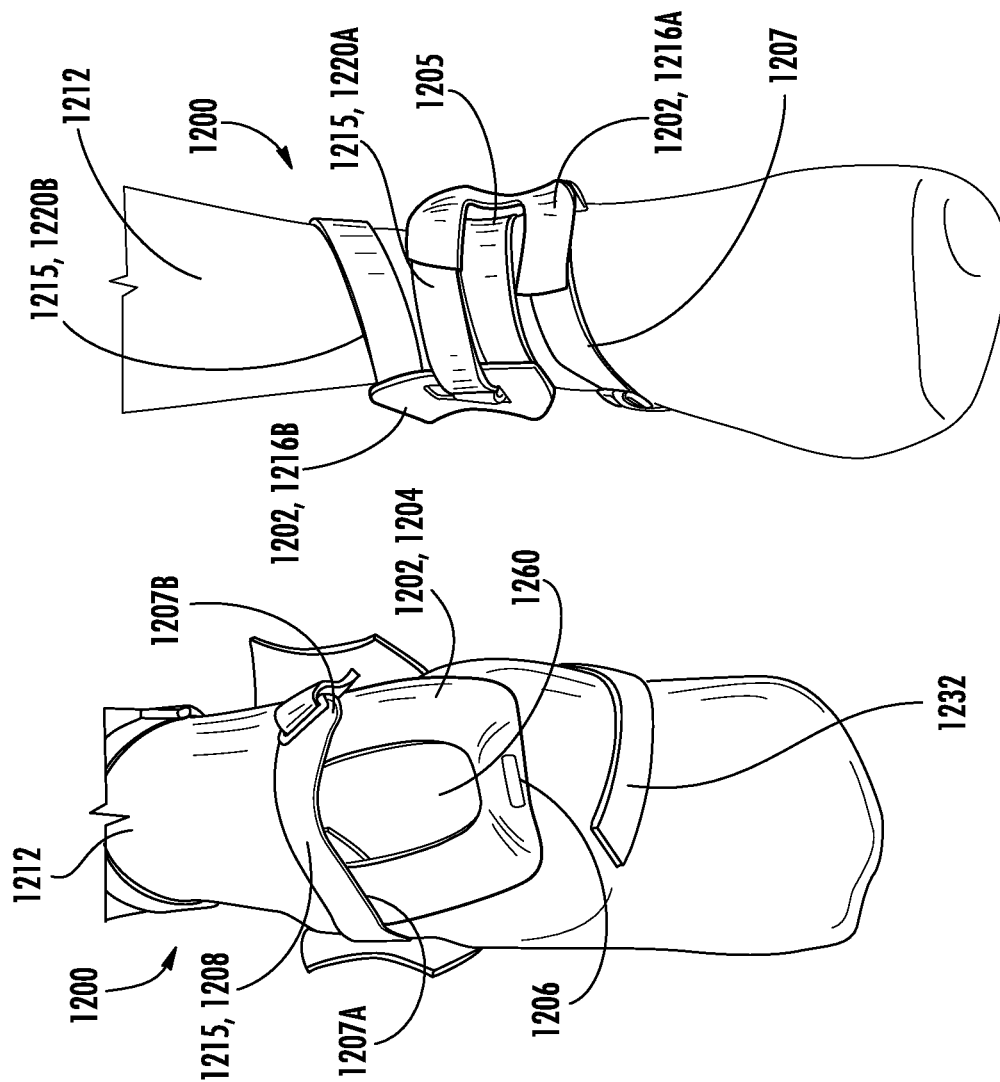
FIG. 10B

FIG. 10A

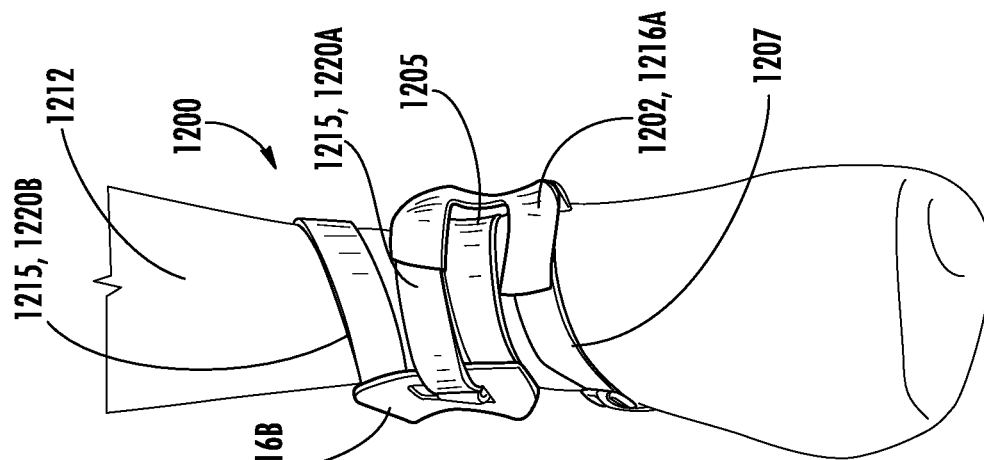




**FIG. 12A**

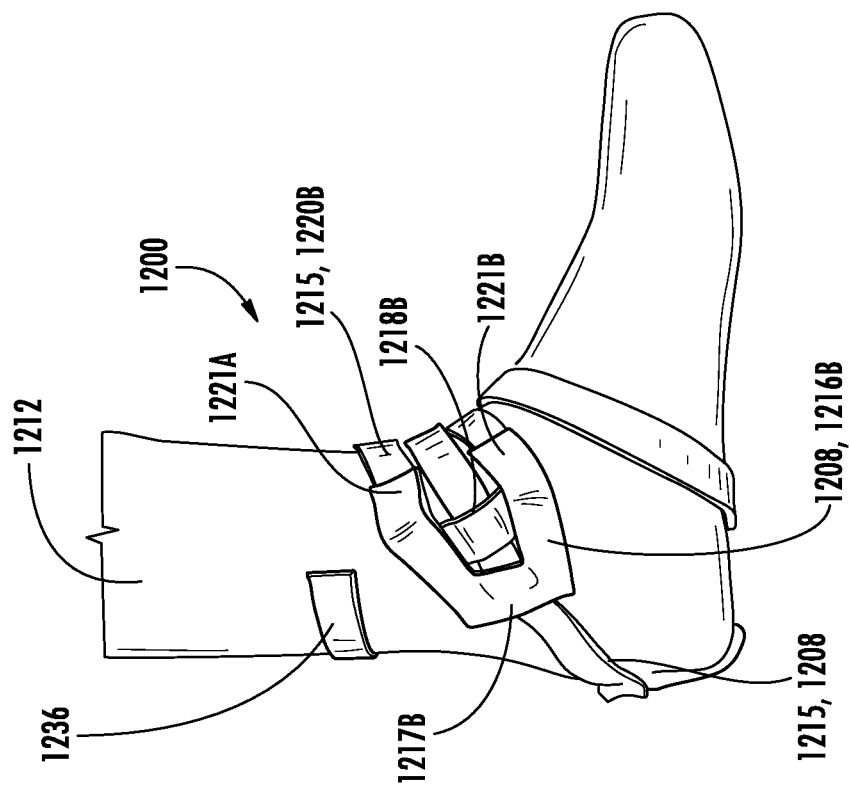


**FIG. 12B**

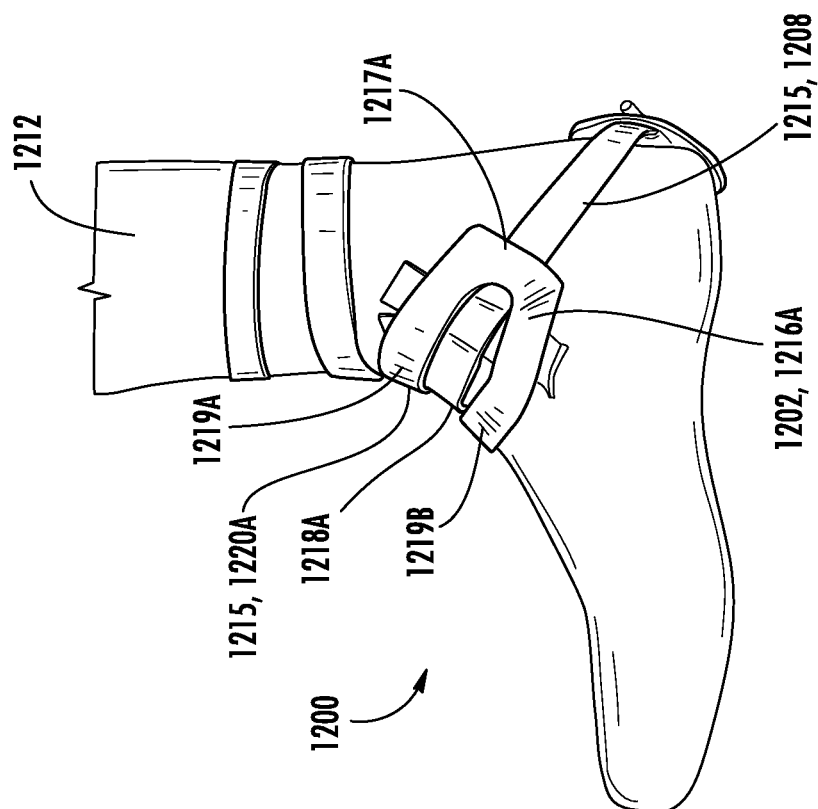


**FIG. 12C**

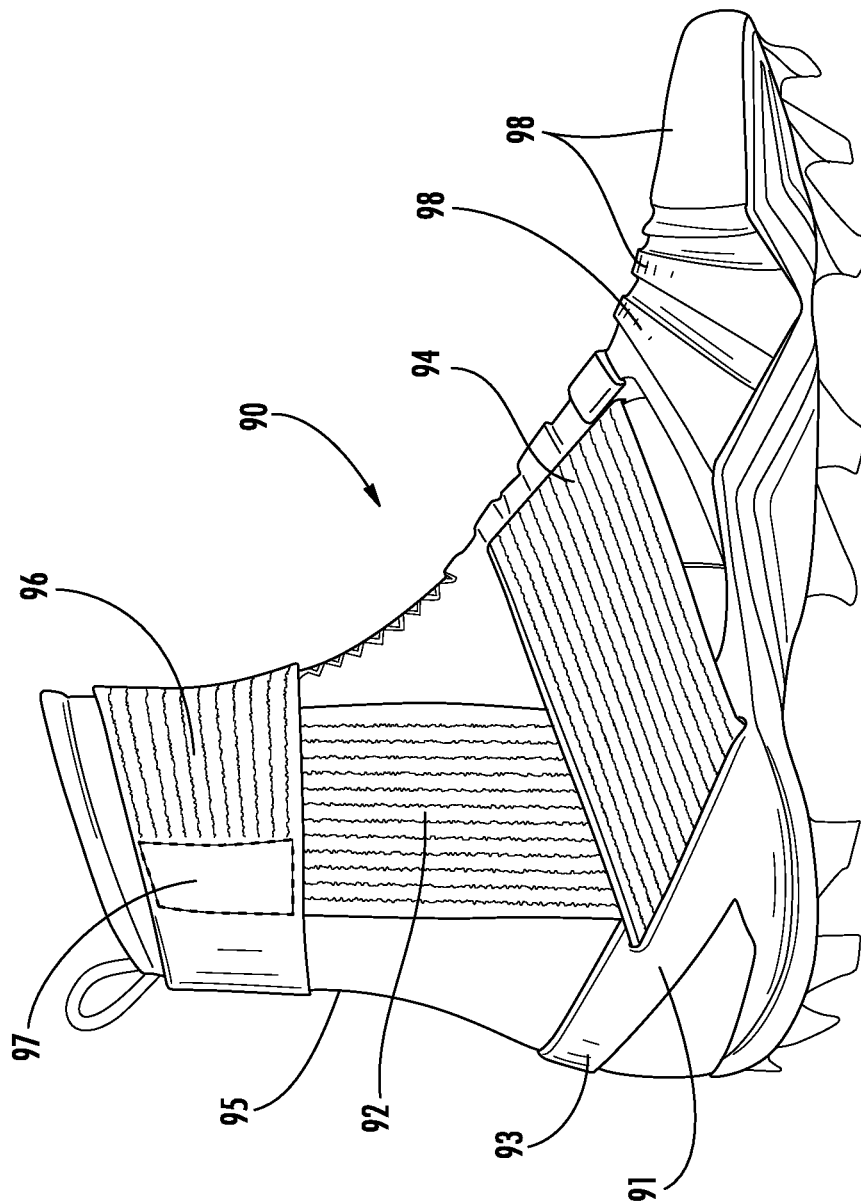




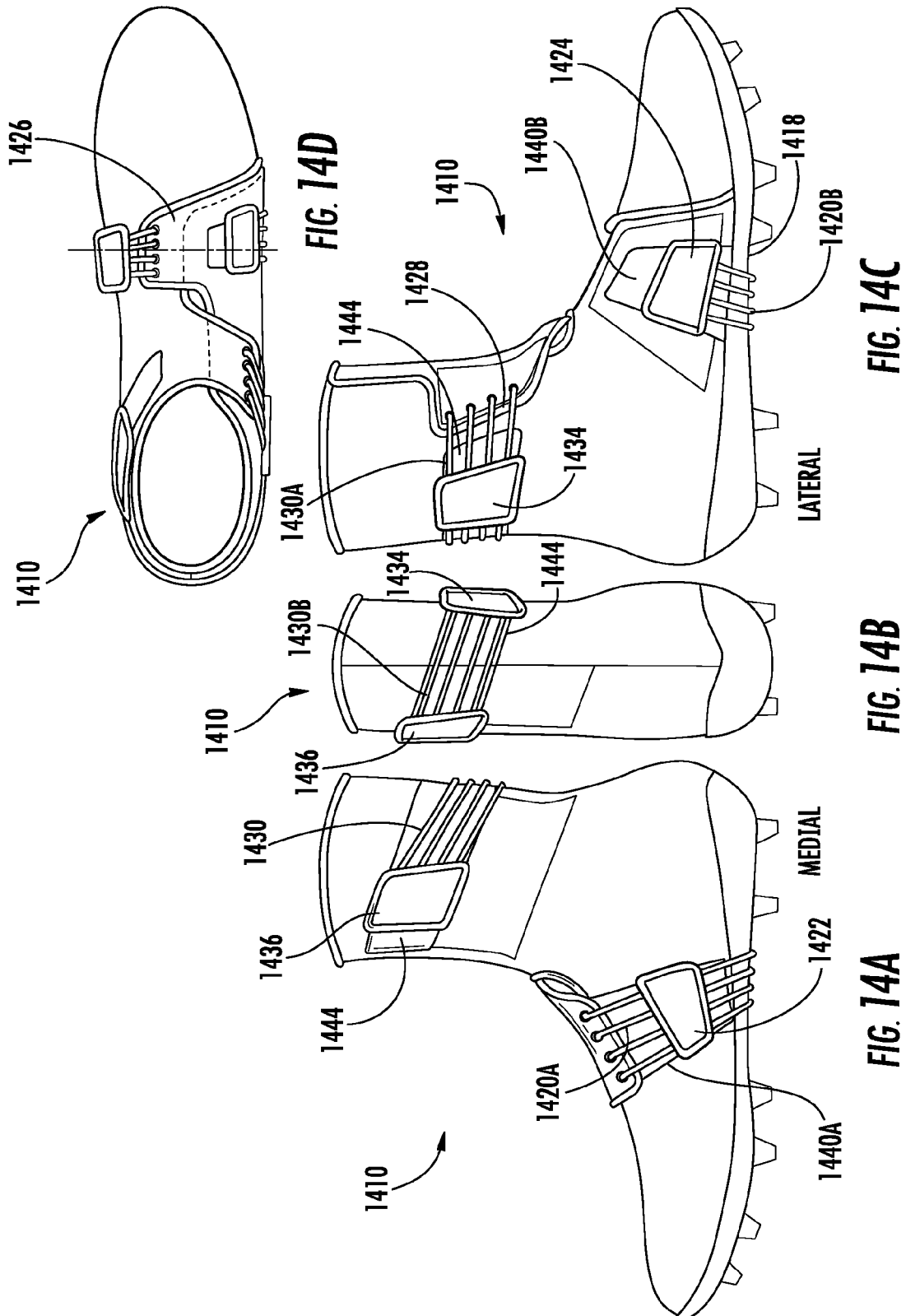
**FIG. 12E**



**FIG. 12D**



**FIG. 13**



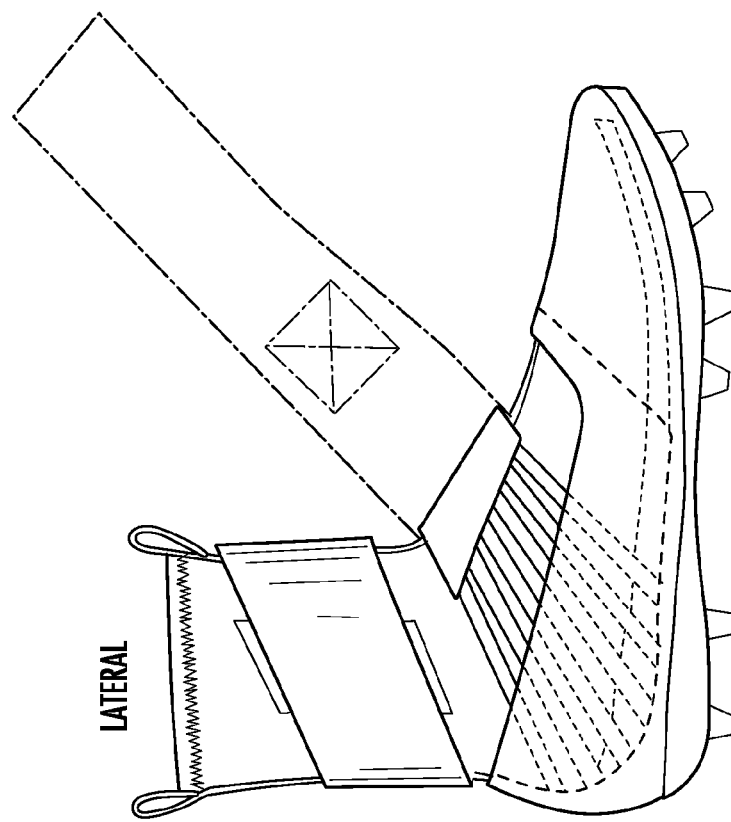


FIG. 15B

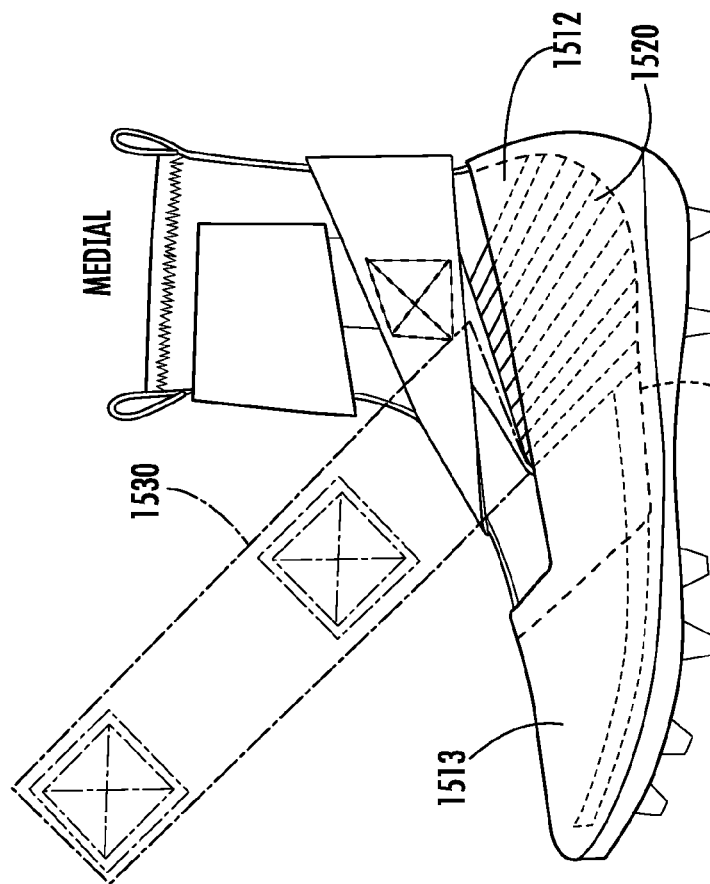
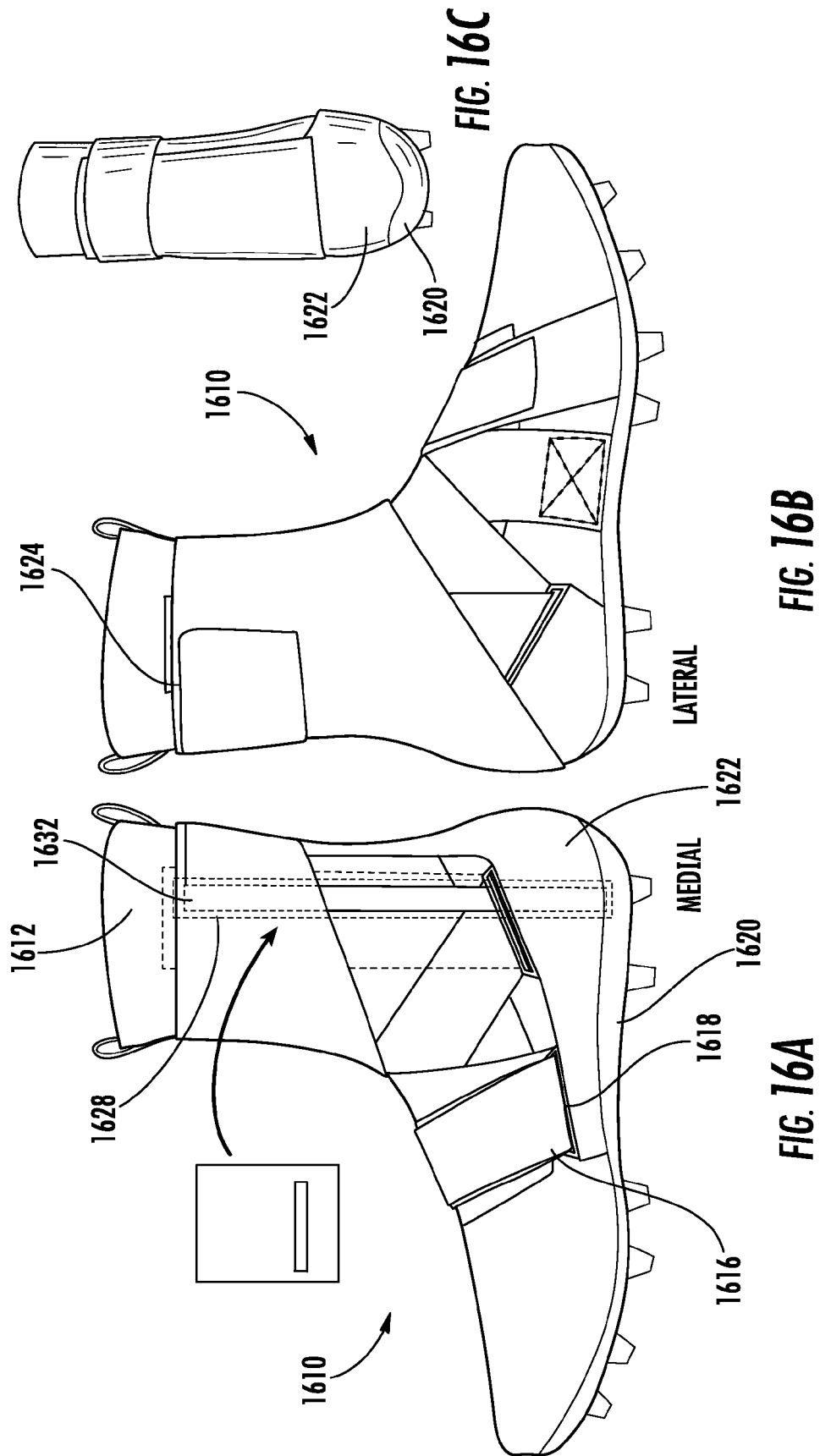


FIG. 15A



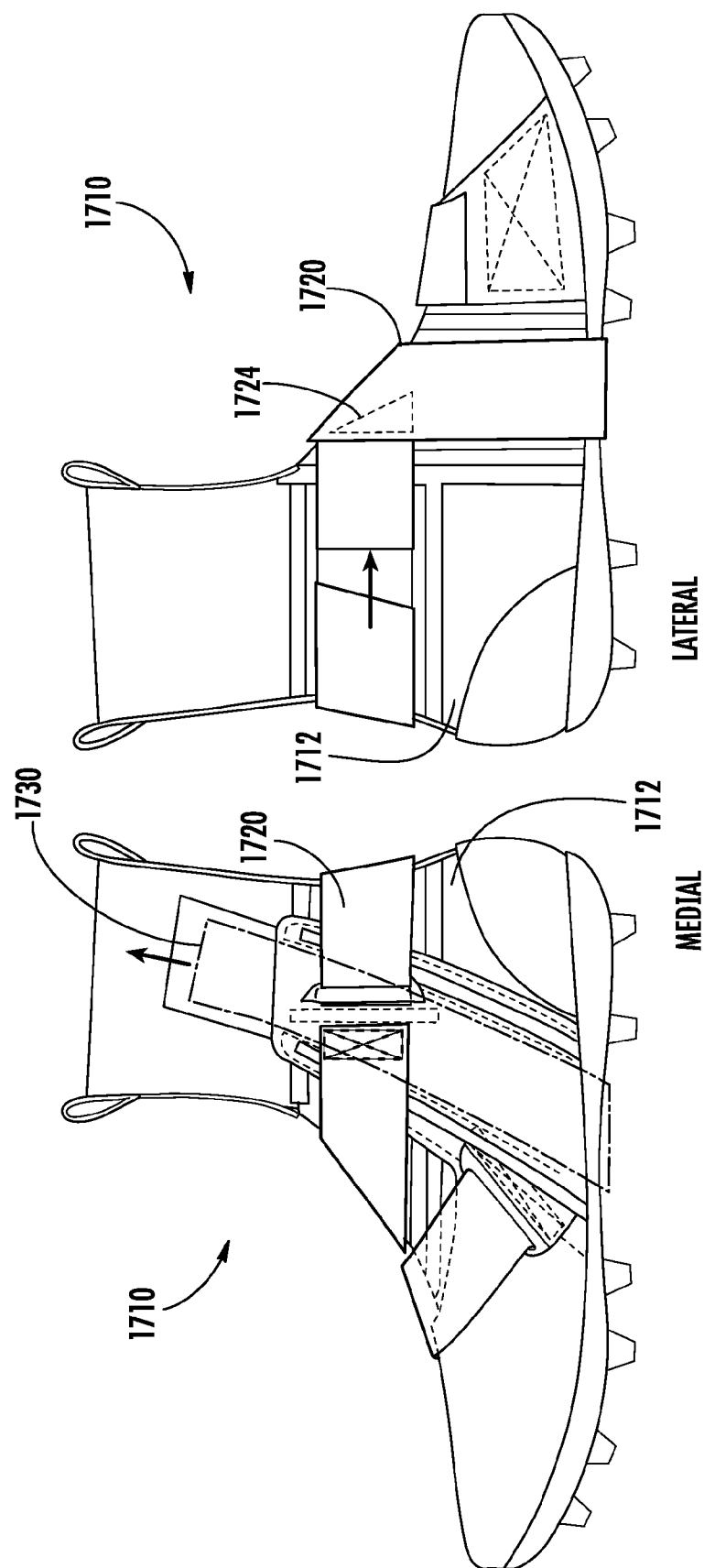


FIG. 17B

FIG. 17A

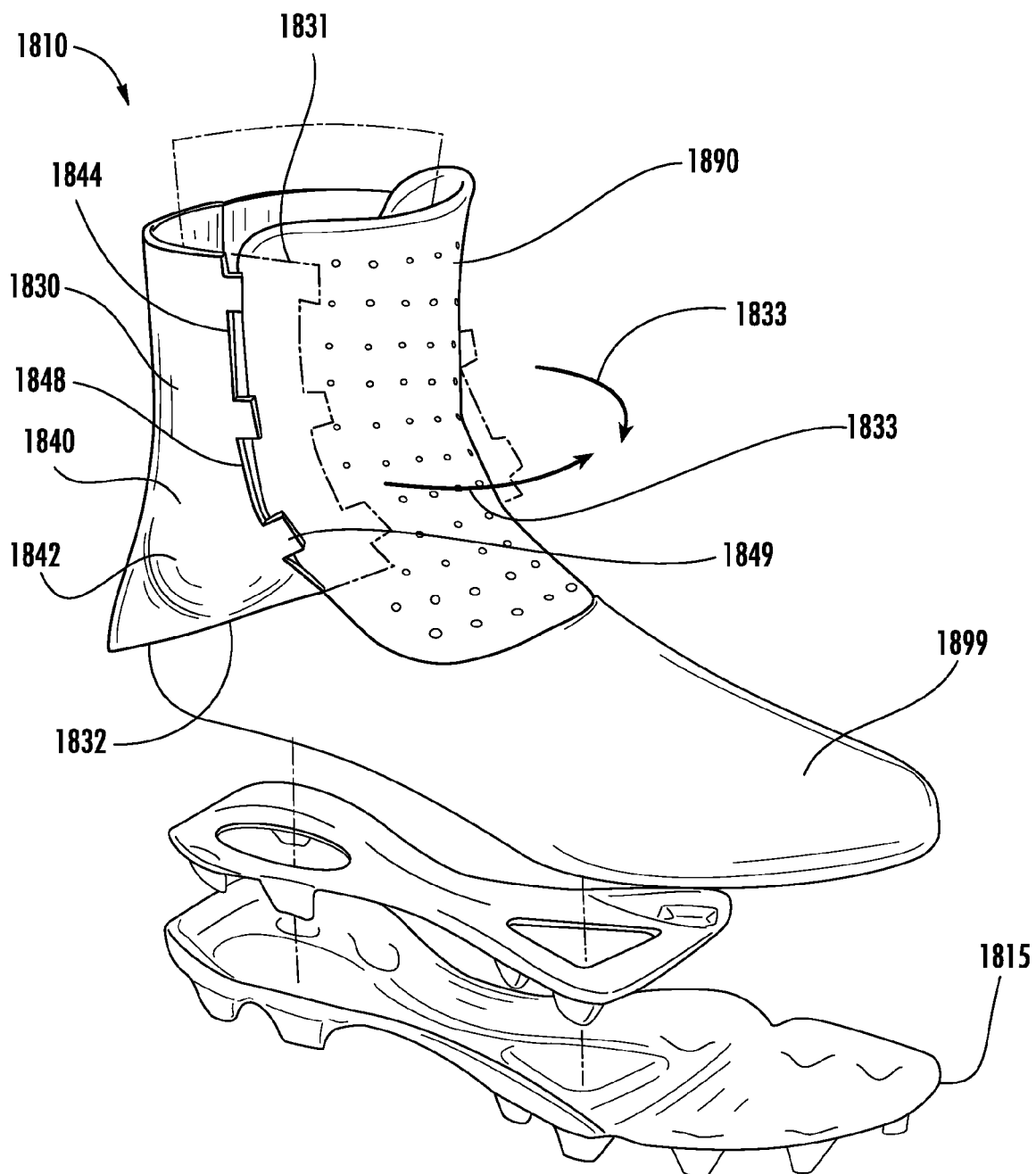


FIG. 18A

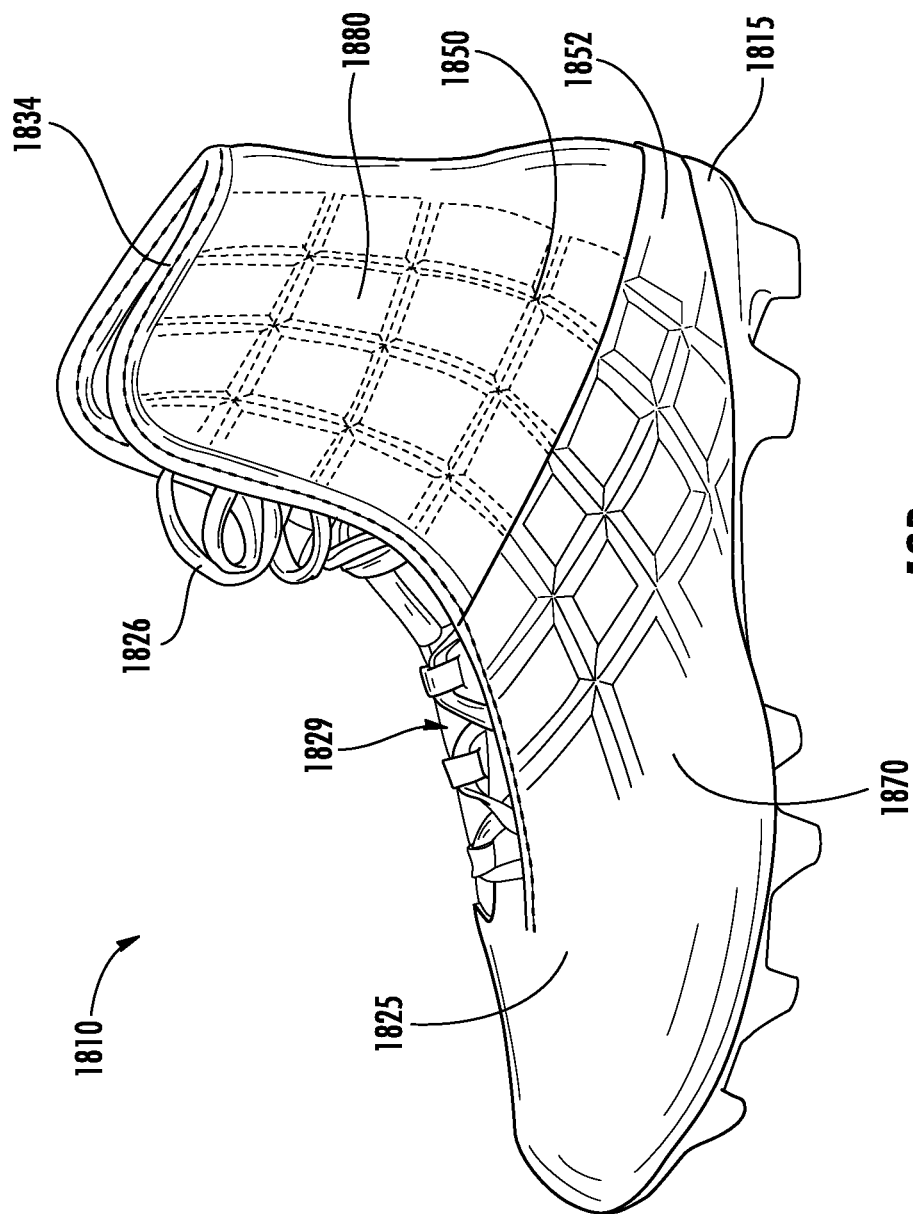


FIG. 18B



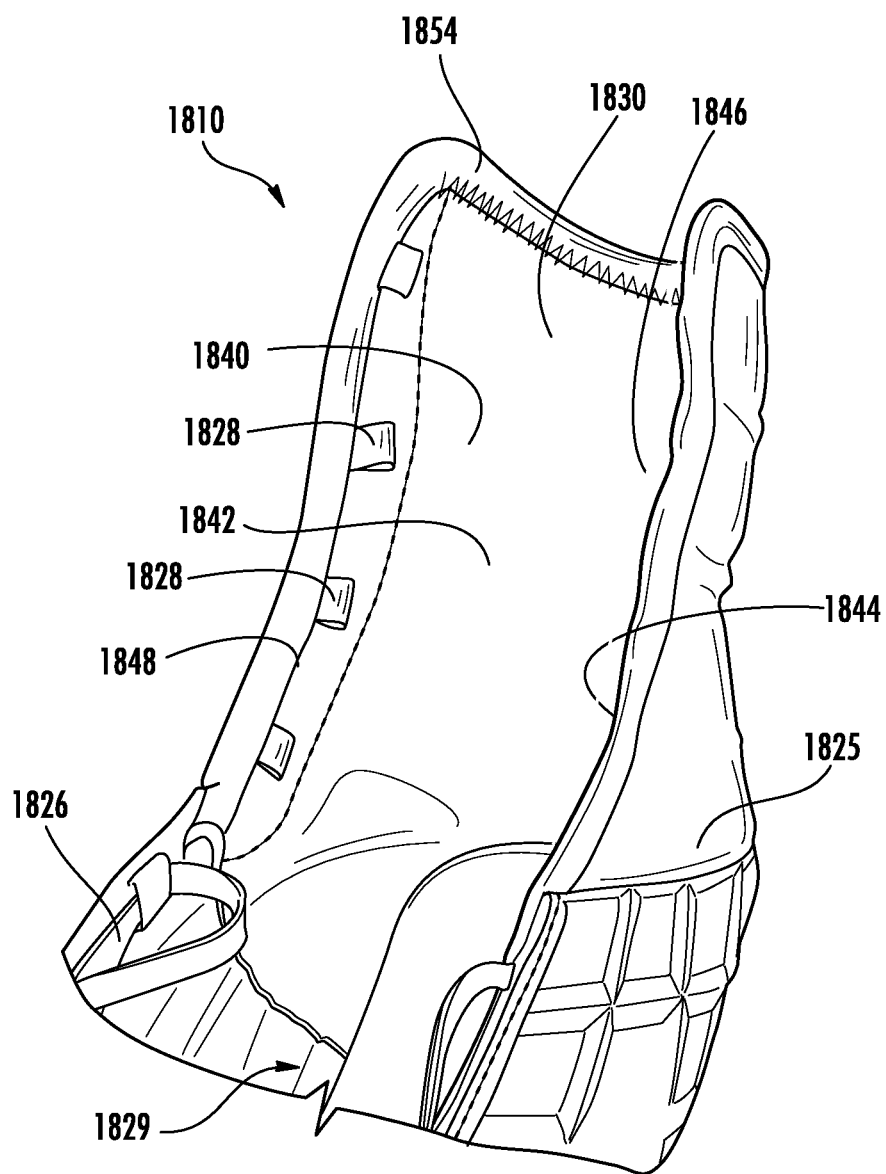
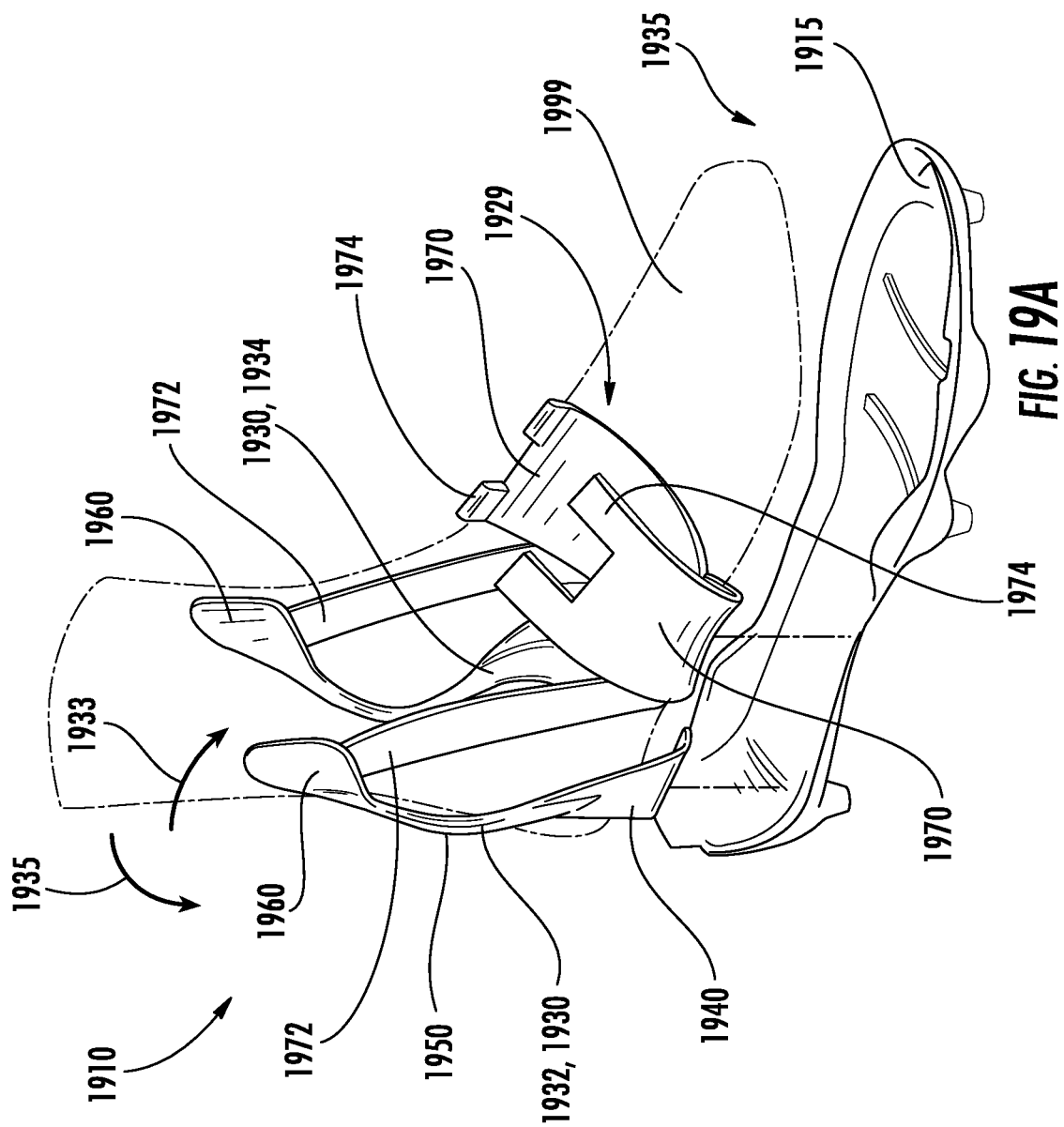
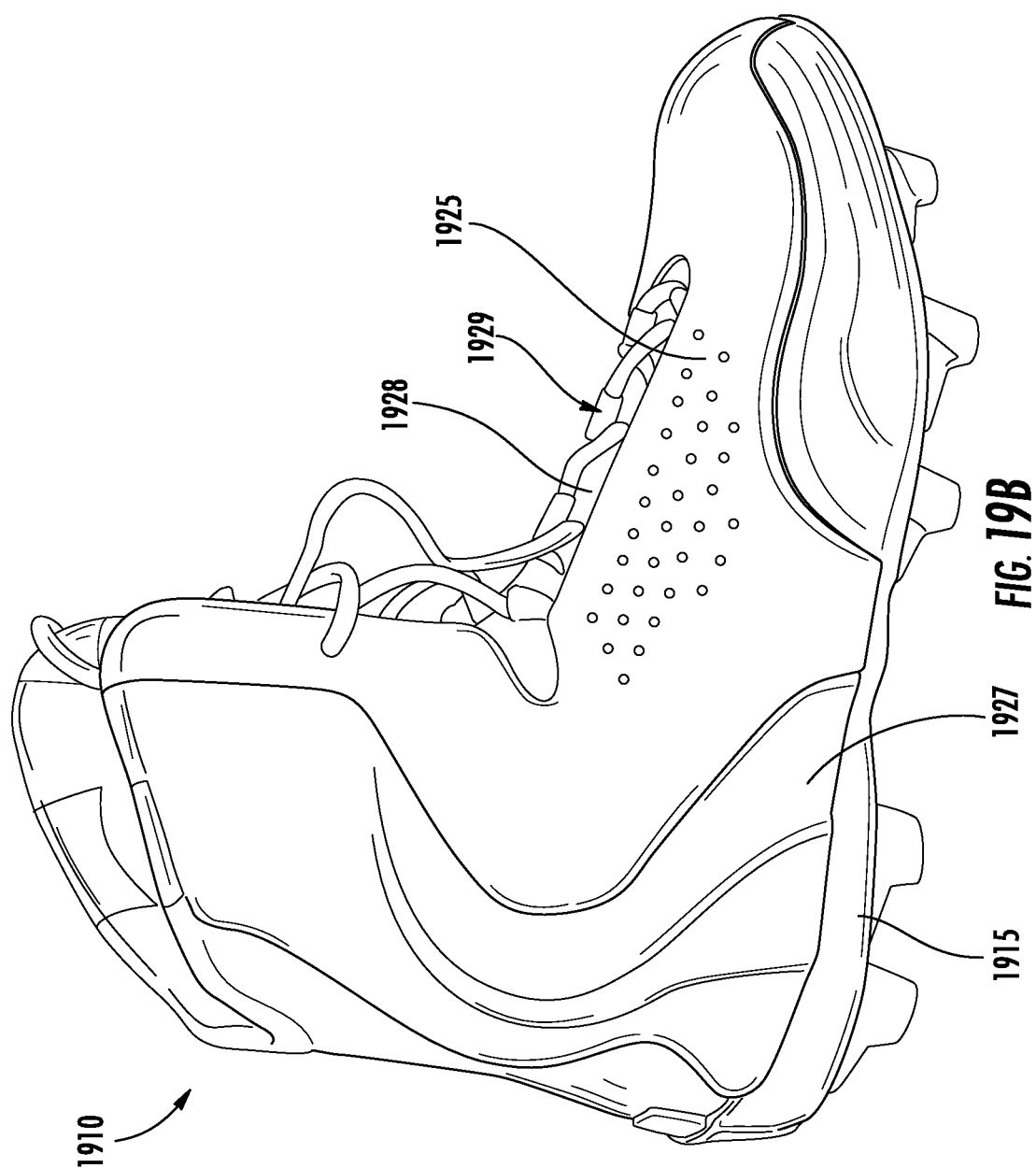


FIG. 18C





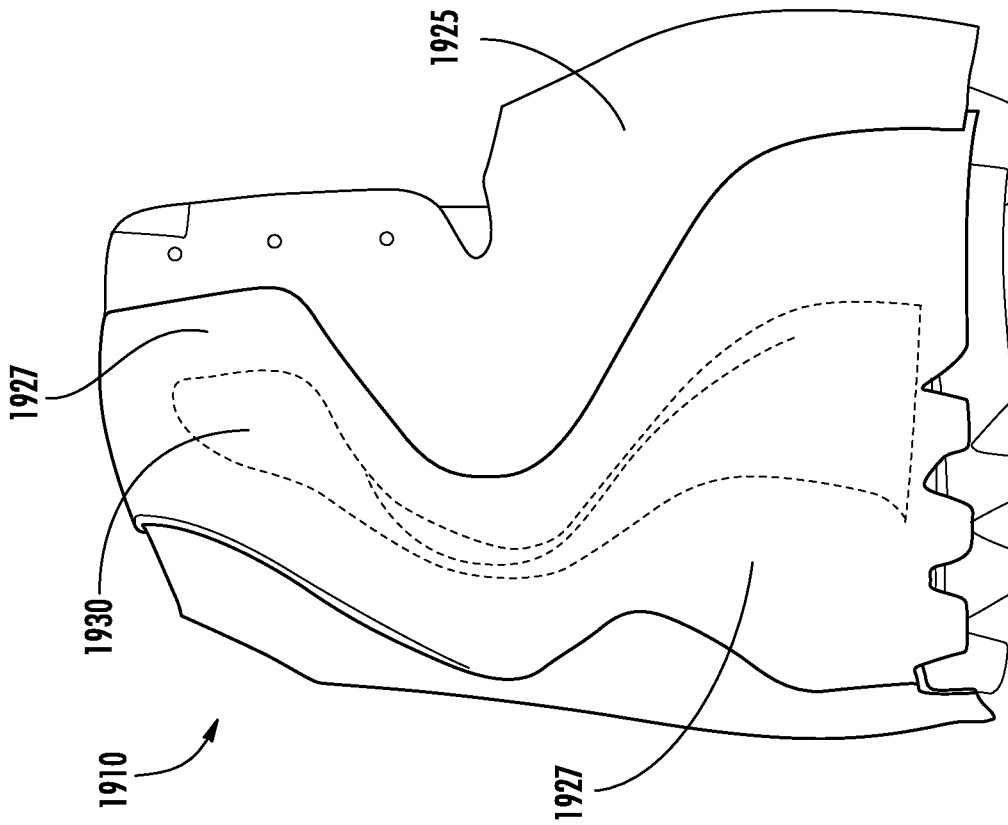


FIG. 19C

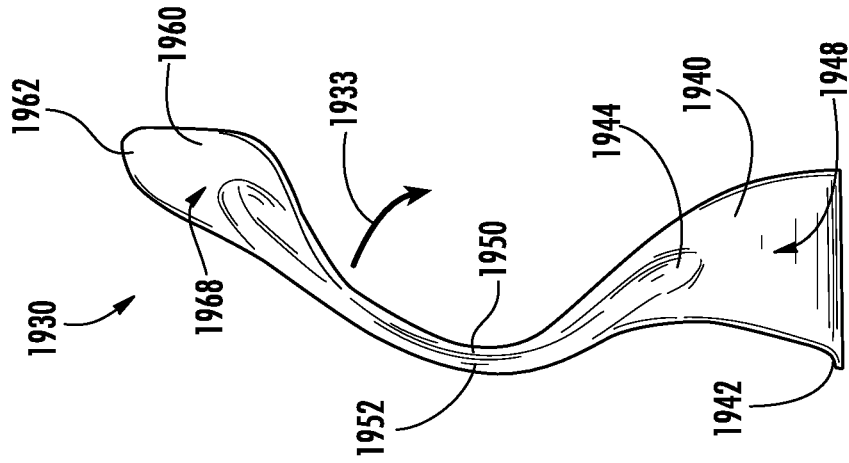


FIG. 19D

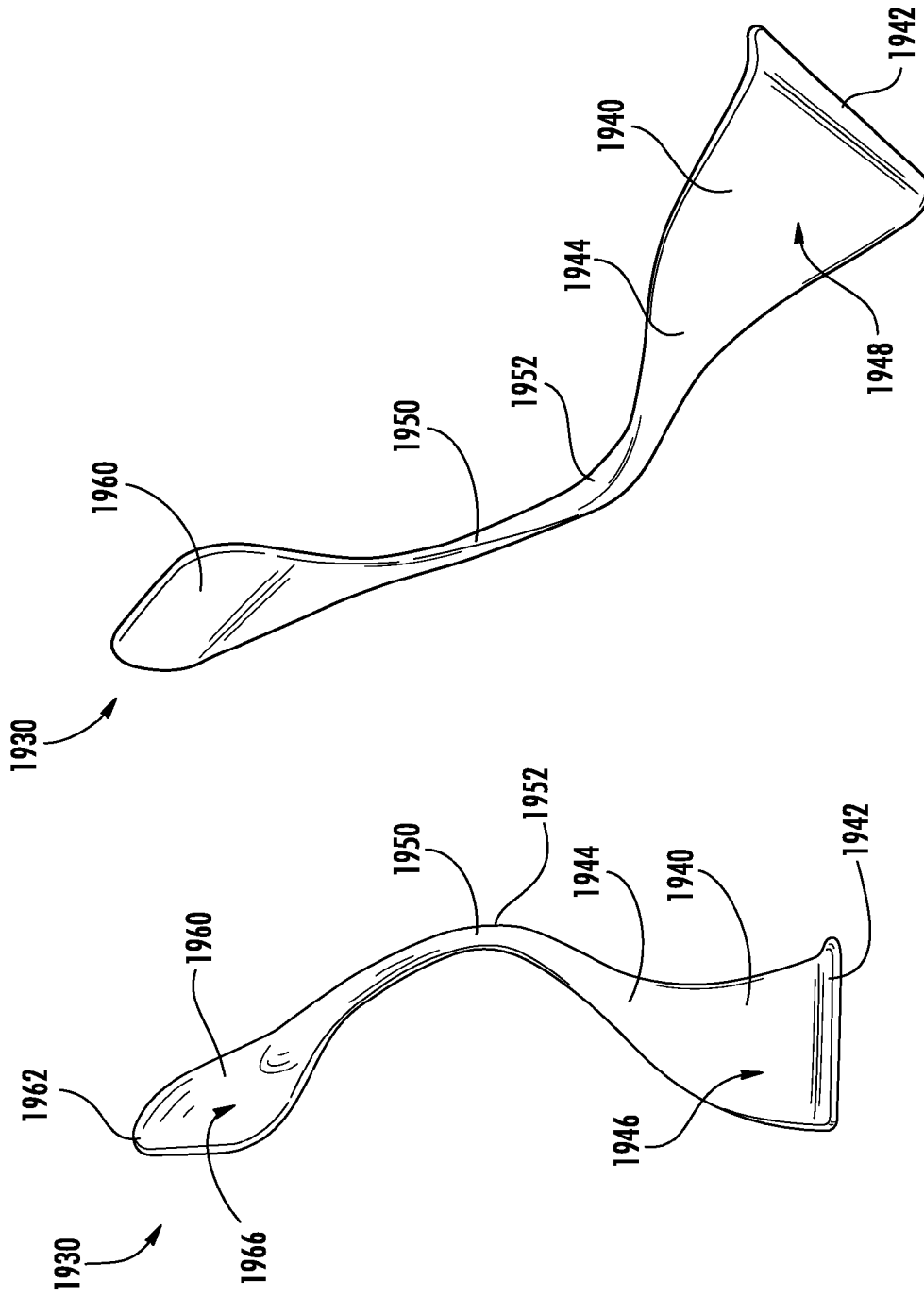


FIG. 19E

FIG. 19F

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**FOOT SUPPORT ARTICLE****CROSS REFERENCE TO RELATED APPLICATIONS**

The present application is a divisional of U.S. patent application Ser. No. 13/157,023, filed Jun. 9, 2011, which is a continuation-in-part of U.S. patent application Ser. No. 13/111,704, filed May 19, 2011, which claims priority from U.S. Provisional Application No. 61/357,075 filed on Jun. 21, 2010, the contents of which are incorporated herein by reference in their entirety.

**FIELD**

The present disclosure relates generally to articles of footwear, and, more particularly, to articles of footwear having foot support members.

**BACKGROUND**

Ankle stability is a key and critical need from athletes and users who deal with lateral motion. There exists a need to provide a simple and lightweight cleat or shoe for athletes in order to offer better support for the foot and ankle region of a user wearing the cleat. Athletes and users take a tremendous amount of time and effort to tape and spat their feet, as well as add additional ankle and foot support braces. The ankle support systems add weight to a footwear system in which lightness is highly desired.

Injuries to the ankle are estimated to account for 15-20% of all musculoskeletal injuries, with approximately 85% being ankle sprains. The most common mechanism of injury is excessive Inversion, coupled with Plantar Flexion—approximately 75-80% involve the lateral ligament complex, primarily the Anterior Talofibular Ligament.

Typically, ankle sprains occur in 40-100 ms. Compared to average muscle latencies: reported latency of 69-85 ms, with approximately 90-110 ms to reach half max force, and an average of 250 ms to reach peak torque generation, the body is not able to adequately respond to an unexpected inversion. In comparison, during running, the stance phase lasts 200-250 ms, and the calf muscles are activated approximately 150 ms prior to heel impact, allowing the ankle adequate time to stabilize.

Players with a history of ankle sprains are 2-3 times more likely to have a recurrent injury than players without history of ankle injuries. Use of bracing or taping, as well as proprioceptive training have been shown to reduce the level of recurrence to the levels of players without history of injury.

In general, both bracing (lace-up and semi-rigid) and taping have been shown to reduce both the frequency and severity of ankle sprains during athletic activities. Semi-rigid braces tend to have a more positive effect for individuals with a history of ankle sprains than for athletes without history. Such lacing and taping methods currently used are time consuming and a waste of resources. Upon the completion of use, the user cuts off and discards the taping. This process increases the time and cost of providing support for the foot and ankle during athletic activities. Thus, improvements to support members that brace the foot and ankle of a person wearing the bracing are beneficial.

**SUMMARY**

In at least one embodiment, an article of footwear includes a sole, an upper defining a foot cavity, and a brace

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member. The brace member is comprised of a non-elastic resilient material. The brace member is positioned within a pocket in the upper and extends from a heel portion to above an ankle portion of the upper.

In at least one embodiment, the brace member includes a top plate member and a base plate member with a central shaft extending between the top plate member and the base plate member. The central shaft portion may be a C-shaped shaft that extends around a rear portion of an ankle of a wearer (i.e., a dorsal side of the ankle). The C-shaped shaft portion includes an inflection point that is wider than other portions of the C-shaped shaft.

In at least one embodiment, an article of footwear comprises a sole and a shoe upper connected to the sole. The shoe upper and the sole define a foot cavity configured to receive a human foot. Laces are positioned on the upper and configured to tighten the shoe upper on the human foot. An elastic wrap member is positioned in the foot cavity. The elastic wrap member is configured to stretch and when the laces tighten the upper on the human foot. In at least one embodiment, the elastic wrap member includes a cradle portion that extends from a heel portion to a top portion of the upper within the foot cavity and is configured to only partially surround the human foot within the foot cavity.

The above described features and advantages, as well as others, will become more readily apparent to those of ordinary skill in the art by reference to the following detailed description and accompanying drawings. While it would be desirable to provide an apparatus that provides one or more of these or other advantageous features as may be apparent to those reviewing this disclosure, the teachings disclosed herein extend to those embodiments which fall within the scope of any appended claims, regardless of whether they include or accomplish one or more of the advantages or features mentioned herein.

**BRIEF DESCRIPTION OF THE DRAWINGS**

FIG. 1A is a cutaway medial side view illustrating the placement of tension members in an article of footwear.

FIG. 1B is a cutaway lateral side view illustrating the placement of tension members in the article of footwear depicted in FIG. 1A.

FIG. 2A is a side view illustrating the medial side of the article of footwear depicted in FIG. 1A.

FIG. 2B is a side view illustrating the lateral side of the article of footwear depicted in FIG. 1B.

FIG. 3 is a top view of tensioning members positioned above the forefoot in the article of footwear depicted in FIG. 2A and FIG. 2B.

FIG. 4 is a side view of adjustment members in the article of footwear depicted in FIG. 2A and FIG. 2B.

FIG. 5 is a view of the tensioning members that are configured to engage a midfoot portion of a foot in the article of footwear depicted in FIG. 2A and FIG. 2B.

FIG. 6 is a view of tensioning members that are configured to engage an ankle in the article of footwear depicted in FIG. 2A and FIG. 2B.

FIG. 7 is a view of an inner layer surrounding a sole of a foot in the article of footwear depicted in FIG. 2A and FIG. 2B.

FIG. 8 is a view of a tensioning strap and support members positioned around an upper portion of a foot and ankle in the article of footwear depicted in FIG. 2A and FIG. 2B.

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FIG. 9 is a side view of an alternative embodiment of footwear that includes support members incorporated into the footwear.

FIG. 10A is a cutaway side view illustrating horizontal and vertical supports on the medial side of the article of footwear depicted in FIG. 9.

FIG. 10B is a cutaway side view illustrating horizontal and vertical supports on the lateral side of the article of footwear depicted in FIG. 9.

FIG. 11A is a cutaway side view of the medial side of an alternative article of footwear illustrating channels that enable movement of tensioning members depicted in FIG. 9.

FIG. 11B is a cutaway side view of the lateral side of an alternative article of footwear illustrating channels that enable movement of tensioning members depicted in FIG. 9.

FIG. 12A is a posterior view illustrating an inner layer and stabilizing member for a heel in an article of footwear.

FIG. 12B is lower posterior perspective view of the inner layer and stabilizing member for a heel depicted in FIG. 12A.

FIG. 12C is an anterior view of the inner layer and stabilizing member for an ankle depicted in FIG. 12A-FIG. 12B.

FIG. 12D is a medial side view of the article of footwear depicted in FIG. 12A-FIG. 12C illustrating the position of an ankle stabilizing member.

FIG. 12E is a lateral side view of an inner layer and stabilizing member for an ankle in the article of footwear depicted in FIG. 12A-FIG. 12D.

FIG. 13 is a partial cutaway view of an alternative embodiment of the article of footwear of FIG. 1A illustrating an alternative tensioning strap arrangement.

FIG. 14A is a side view illustrating a medial side of an alternative arrangement of tensioning members in an article of footwear.

FIG. 14B is a side view illustrating a rear side of an alternative arrangement of tensioning members in an article of footwear.

FIG. 14C is a side view illustrating a lateral side of an alternative arrangement of tensioning members in an article of footwear.

FIG. 14D is a top view illustrating a top side of an alternative arrangement of tensioning members in an article of footwear.

FIG. 15A is an illustration depicting tensioning members attached to a strap in a medial side of an article of footwear.

FIG. 15B is an illustration depicting tensioning members attached to a strap in a lateral side of an article of footwear.

FIG. 16A is an illustration depicting the positions of tensioning straps and a support member in a medial side of another alternative embodiment of an article of footwear.

FIG. 16B is an illustration depicting the positions of tensioning straps and a support member in a lateral side of another alternative embodiment of an article of footwear.

FIG. 16C is an illustration depicting the positions of tensioning straps and a support member in a rear side of another alternative embodiment of an article of footwear.

FIG. 17A is an illustration of a tensioning strap in a medial side of an alternative embodiment of an article of footwear.

FIG. 17B is an illustration of a tensioning strap in a lateral side of an alternative embodiment of an article of footwear.

FIG. 18A is an illustration of an alternative embodiment of an article of footwear including an elastic wrap member positioned in the foot cavity.

FIG. 18B shows a side view of the article of footwear of FIG. 18A.

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FIG. 18C shows a perspective view of the foot cavity of the article of FIG. 18A with the elastic wrap member positioned in the foot cavity.

FIG. 19A is an illustration of an alternative embodiment of an article of footwear including support braces carried by the shoe upper.

FIG. 19B shows a side view of the article of footwear of FIG. 19A.

FIG. 19C shows a view of a pocket in the shoe upper carrying the support brace of FIG. 19A.

FIG. 19D shows a view of an outer face of the support brace of FIG. 19A.

FIG. 19E shows a view of an inner face of the support brace of FIG. 19A.

FIG. 19F shows a perspective view of the support brace of FIG. 19A.

#### DETAILED DESCRIPTION

For a general understanding of the details for the footwear disclosed herein, the drawings are referenced throughout this document. In the drawings, like reference numerals designate like elements. As used herein the term “foot” may refer to a portion of the human foot, a full human foot, and to the ankle. Various portions of the foot include, but are not limited to, the forefoot, midfoot, upper foot, heel, and ankle. The terms “medial” and “medial side” refer to the inner side of a foot extending from the large toe to the heel, and the terms “lateral” and “lateral side” refer to the outer side of the foot extending from the small toe to the heel. The term “user” may refer to a person wearing an article of footwear or another person such as an athletic trainer. The user may adjust the article of footwear to apply compression and support to the foot as described herein.

#### Article of Footwear with Tensioning Members

FIGS. 1A-8 depict an article of footwear, embodied here as a cleat 10, having an inner layer 12 positioned inside of an outer shell 13 (illustrated by dotted line 13 in FIG. 1A and FIG. 1B). FIG. 1A depicts the medial side of cleat 10, while FIG. 1B depicts the lateral side of the cleat 10. FIG. 2A and FIG. 2B depict the cleat 10 including features omitted from FIG. 1A and FIG. 1B for clarity. Cleat 10 includes an inner layer 12 that conforms to the foot and ankle region of a user. The cleat 10 includes tensioning members 16 that may be adjusted by the user of the cleat 10 to provide compression to various portions of the foot 14 after the foot 14 is inserted into the cleat 10. Tensioning members 16 include forefoot tensioning members 16A-16B, midfoot tensioning members 20A-20B, upper foot tensioning members 30A-30B, and tensioning straps 52, as explained below. Cleat 10 may be worn on a foot 14 that is inserted inside of the cleat 10. While the illustrations of FIG. 1A-FIG. 1B depict different numbers of tensioning members than FIG. 2A-FIG. 2B, it will be understood that these figures depict the same embodiment of an article of footwear and that the different numbers of tensioning members 16 seen in FIG. 1A-FIG. 1B are simply intended to illustrate that different numbers and arrangements of tensioning members 16 are possible within various embodiments of the article of footwear. While FIG. 1A-FIG. 2B depict a cleat 10 with one or more spikes 17 or other projections, alternative embodiments may include any suitable shoe, footwear, boot, and other articles that may be worn around the ankle and/or foot.

The inner layer 12 may be comprised of any material that provides the user with comfort and functionality. Such materials include, but are not limited to, compression fabrics, polypropylenes, webbing, neoprene, elastane, synthet-

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ics, and the like. The inner layer 12 may be formed as a flexible boot or sock that conforms to the foot and ankle. The inner layer 12 accommodates the foot 14 and is configured to fit snugly about the foot and ankle 14. As seen in FIG. 1A and FIG. 1B, one or more sleeves 19 may be affixed to the inner layer 12. The sleeve 19 separates the tensioning members 16 from the outer shell 13 and includes one or more channels 27. Channels 27 enclose the tensioning members 16 to enable tightening and loosening of the tensioning members 16 and to prevent tangling of the different tensioning members 16 in the article of footwear 10. In the embodiment of FIG. 1A and FIG. 1B, the article of footwear 10 provides a channel for each tensioning member in the article of footwear, but alternative configurations may include channels 27 for only a limited number of the tensioning members 16.

The outer shell 13 may be formed from one or more flexible materials that enclose some or all of the inner layer 12. Such materials include, but are not limited to, natural and synthetic leather, fabrics including nylon and canvas, rubber, and plastics. The outer shell 13 includes a lower portion or sole 15 that is attached to an upper portion 25, referred to as an “upper” that is attached to the sole 15. The sole 15 and upper 25 form a volume that is referred to as a “foot cavity”. The foot cavity accommodates the foot of a person wearing the cleat 10. The foot cavity also holds the inner layer 12 and portions of the tensioning members 16. In various alternative embodiments described below, different support members and stabilizing members are also positioned inside the foot cavity. The inner layer 12 may be permanently attached to the outer shell 13 of the cleat 10, or alternatively the outer shell 13 may be selectively removable from the inner layer 12 to aid in fitting the cleat 10 to the foot.

As shown in FIG. 1A-FIG. 8, the plurality of tensioning members 16, include forefoot tensioning members 16A and 16B, midfoot tensioning members 20A and 20B, upper foot tensioning members 30A and 30B, and tensioning straps 50A and 50B. Each of the tensioning members 16 may be adjusted to apply a selected compressive force to a corresponding region of the foot 14 inside of the cleat 10. As exemplified by forefoot tensioning member 16B in FIG. 1A, each of the tensioning members 16 in cleat 10 has a first end 16B<sub>1</sub> attached to the inner layer 12 inside of the foot cavity, and a second end 16B<sub>2</sub> that extends to a position outside of the foot cavity and the outer shell 13, depicted with a dotted line in FIG. 1A-FIG. 1B. In the example embodiment of cleat 10, the end 16B<sub>2</sub> that extends outside of the outer shell 13 is attached to a tab 18B. Tab 18B is one of the tension adjustment members 18 shown with cleat 10. The tension adjustment members 18 provide a surface that the user may grip to tighten or loosen the tensioning members 16 that are attached to the corresponding tab 18. The tension adjustment members 18 are also configured to be secured to the outer shell 13 or otherwise locked in place in order to enable the tensioning members 16 to continue to apply a compressive force to the foot 14 after the user adjusts and releases the tensioning members 16. The tensioning members 16 included in cleat 10 are described in more detail below.

The exemplary embodiment of cleat 10 includes two sets of crisscrossing forefoot tensioning members 16A and 16B. As illustrated in FIGS. 1A-2B as well as FIGS. 3, and 4, forefoot tensioning members 16A-16B are located on a forefoot region of the cleat 10. FIG. 1B depicts one set of forefoot tensioning members 16A that are attached to the lateral side of the inner layer 12 and cross to the medial side of the cleat 10. FIG. 1A depicts another set of the forefoot tensioning members 16B that are attached to the medial side

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of the inner layer 12 and cross to the lateral side of the cleat 10. The tensioning members 16A and 16B are shown as straps formed from an inelastic fabric material. Alternative tensioning member configurations may use one or more members formed from an elastic or inelastic material, including one or more elastic bands that are configured to stretch in response to tension. FIG. 2A-FIG. 3 depict the tensioning members 16A and 16B arranged in a crisscross pattern. The ends of each set of tensioning members 16A and 16B positioned outside of the outer shell 13 are affixed to one of a pair of forefoot tabs 18A and 18B, respectively. The forefoot tabs 18A and 18B each engage with one of corresponding fastening pads 40A and 40B, respectively, positioned on the outer shell 13 of the cleat 10.

As best shown in FIGS. 1A-1B, 2A-2B, and 4, tabs 18A and 18B include a hoop or loop material on an inner side designed to engage an opposing hook and loop material on the fastening pads 40A and 40B. The hooks may be either unidirectional or multidirectional. Fastening pads 40A and 40B are examples of fastening locations, which are predetermined locations positioned on the outer shell 13 that are configured to fasten one or more tensioning members in place. In lieu of to the hook and loop material, any fastener that holds the tabs 18 in position with respect to the outer shell 13 may be used including, for example, nanoadhesive materials, and snap closures. The tensioning members 16 may include ridged structures that engage a ratcheting fastening location to enable the tensioning member to lock in place. A lever or dial may provide mechanical advantage to enable application of force to tighten and loosen tensioning member.

As illustrated in FIG. 1A-FIG. 2B, in conjunction with FIG. 5, midfoot tensioning members 20A and 20B are located in a midfoot region of the cleat 10. The midfoot tensioning members 20A are attached to the lateral side of the inner layer 12 and extend to the medial side of the outer shell 13 terminating in midfoot tab 22A. The midfoot tensioning members 20B are attached to the medial side of the inner layer 12 and extend to the lateral side of the outer shell 13 terminating in midfoot tab 22B. FIG. 5 depicts midfoot tensioning members 20B stitched to member 23B that attaches the tensioning members 20B to the inner layer 12. The midfoot tensioning members 22A and 22B are arranged in a crisscross pattern across the midfoot region. Midfoot tabs 22A-22B are configured to engage with a corresponding attachment pad 40A-40B positioned on the outer shell 13 in a similar manner to the forefoot tensioning members 16A-16B.

As illustrated in FIG. 1A-FIG. 2B in conjunction with FIG. 6 and FIG. 8, upper foot tensioning members 30A and 30B are located in an ankle and upper foot region of the cleat 10. The upper foot tensioning members 30A are attached to the lateral side of the inner layer 12 and cross to the medial side, terminating in an upper foot tab 32A. Upper foot tensioning members 30B are attached to the medial side of the inner layer 12 and extend to the lateral side, terminating in a second upper foot tab 32B. The upper foot tensioning members 30A and 30B are arranged in a crisscross pattern across the upper foot region. Upper foot tabs 32A and 32B have a hook and loop material on an inner side and outer side of each tab. The hook and loop material on the inner side fastens to a corresponding hook and loop fastener positioned on the outer shell 13. The hook and loop material on the outer side of each of the upper foot tabs 32 provides a fastening location for one of the tensioning straps 50A and 50B. As explained in further detail below, a user may adjust the tension of the upper foot tensioning members 30A and



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30B and then secure the tabs 32A and 32B to the outer shell 13 in order to apply a continuing compressive force to the foot.

With particular reference to FIG. 2A-FIG. 2B in conjunction with FIG. 7 and FIG. 8, the cleat 10 further includes a pair of tensioning straps 50A and 50B. Each of the tensioning straps 50A and 50B has one end attached to the inner layer 12, and a second end attached to a pull tab 52. As shown in FIG. 7, tensioning strap 50A has one end 54 attached to the inner layer 12, and the tensioning strap 50A is routed underneath the foot. A second tensioning strap 50B crosses the first tensioning strap 50A, extends longitudinally from the heel 60, and terminates at a pull tab 52. FIG. 1, FIG. 2, and FIG. 7 show cleat 10 with two tensioning straps 50A and 50B. An alternative embodiment, however, may only use a single tensioning strap. The tensioning straps 50A and 50B crisscross and run substantially longitudinally along the ankle and lower leg and terminating with pull tabs 52A and 52B, respectively. Pull tabs 52A and 52B include a hook and loop fastener material that compliments the material on the outer surface of the upper foot tabs 32. While in the present embodiment, tensioning straps 50A and 50B are shown as attached in the vicinity of the midfoot and forefoot, an alternate embodiment includes adjustable attachment means, such as hook and loop fasteners, rather than permanent attachment.

In operation, the user first inserts a foot 14 inside the inner layer 12 positioned in the foot cavity formed inside the sole 15 and upper 25. The foot 14 slides into the inner layer 12 and seats the heel of the foot into the heel portion 60. When inserting the foot 14, tabs 18A-18B, 22A-22B, 32A-32B and the pull tabs 52A-52B are disengaged from counterpart fastening locations. The user may then apply a compressive force to the foot 14 using one or more of the tensioning members 16 on the cleat 10. In one embodiment, the user pulls forefoot tabs 18A and 18B away from each other to apply a tensile force that tightens the forefoot tensioning members 16A and 16B. The user engages the forefoot tab 18A-18B with the forefoot of the cleat 10 thus maintaining and locking in the applied tension on the forefoot tensioning members 16A-16B. The user pulls midfoot tabs 22A and 22B away from each other to applying a tensile force that tightens the midfoot tensioning members 20A and 20B. The user then engages the midfoot tabs 22A and 22B with the midfoot of the cleat 10 thus maintaining and locking in the applied tension on the midfoot tensioning members 20A and 20B. The user pulls upper foot tabs 32A and 32B away from each other to apply a tensile force that tightens the upper foot tensioning members 30A and 30B. The user then engages the upper foot tabs 32A and 32B with the upper foot of the cleat 10 thus maintaining and locking in the applied tension on the upper foot tensioning members 30A and 30B. The forefoot tensioning members 16A-16B, midfoot tensioning members 20A-20B, and the upper foot tensioning members 30A-30B may be tightened in any order.

Once tension has been applied to the tensioning members 16A-16B, 20A-20B, and 30A-30B, the user uses pull tabs 52 to pull and apply a tensile force to the tensioning straps 50. The user pulls the pull tabs 52 to apply a selected tensile force to the tensioning straps 50A and 50B, and engages pull tabs 52A and 52B with the upper foot tabs 32A and 32B, respectively, to secure the tensioning straps 50A and 50B in the selected position. The result of the aforementioned tensioning enables the user to fully lock the cleat 10 about the foot and ankle region. In an alternative embodiment, the tensioning straps 50A and 50B may have fastening material such as hook and loop material positioned on both sides of

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the tensioning straps 50A and 50B. In this embodiment, the user pulls on tensioning straps 50A and 50B to apply compression to the foot 14 prior to adjusting the upper foot tabs 32A and 32B.

When one of the tensioning members 16A-16B, 20A-20B, 30A-30B, and 50A-50B inside of the outer shell 13 is tightened, the effective length of the tightened tensioning member inside of the outer shell 13 decreases, and the effective length of the portion of the tensioning member that extends through the outer shell 13 increases. The term "effective length" refers to the proportion of the length of one or more of the tensioning members 16 that is either inside of or outside of the outer shell 13. As the effective length of one of the tensioning members 16 increases inside the outer shell 13, the corresponding effective length decreases outside of the outer shell 13, and vice versa. Each of the tensioning members 16A-16B, 20A-20B, 30A-30B, and 50A-50B may be loosened as well as tightened. Each tensioning member may be loosened when a corresponding tension adjustment member 18 for a tensioning member 16 is detached from a corresponding attachment location of the cleat 10. The user may loosen the tensioning member and then engage the tab with a corresponding attachment location to maintain the applied tension. When one of the tensioning members 16A-16B, 20A-20B, 30A-30B, and 50A-50B is loosened, the effective length of the loosened tensioning member inside of the outer shell 13 increases, and the effective length of the portion of the tensioning member that extends through the outer shell 13 decreases.

#### Article of Footwear with Support Members

With reference to FIG. 9-FIG. 10, an alternative embodiment of an article of footwear 900 is disclosed that includes support members 100 and 102. The support members 100 and 102 enable the footwear article 900 to retain a predetermined shape and continue providing support to a foot inserted in the footwear article 900 when the various tensioning members described above apply compression to the foot 14. The support members 100 and 102 provide a stiffening force to the footwear article 900 to prevent the ankle and foot from rolling or spraining. The support members 100 and 102 may be incorporated with any of the embodiments of footwear and modifications thereof that are described in this application.

Footwear article 900 includes vertical supports 100 and horizontal supports 102 shown in FIG. 9. Vertical supports 100 are oriented in a substantially longitudinal direction with the ankle and lower leg of a foot inserted in the footwear article 900. The vertical supports 100 are integrated into an inner layer of the footwear article 900 similar to inner layer 12 seen above. Vertical supports 100 originate proximate the bottom of the inner layer and run the length thereof. The vertical supports 100 may be removable or permanently affixed to the inner layer. Additionally, the vertical supports may follow the contours of the foot. Additionally, the footwear article 900 may include horizontal supports 102 that are oriented in a substantially longitudinal with the foot inserted in the footwear article 900. The horizontal supports 102 may be operably connected to the eyelets or lacing system 104 of the footwear article 900 or to the tensioning members 16 described above.

As shown in FIG. 10, the vertical supports 100 and horizontal supports 102 may be formed from one or more members formed from a polymer such as a thermoplastic polyurethane (TPU) material. In the embodiment of FIG. 9 and FIG. 10, the TPU forming the supports 100 and 102 is approximately 3 mm thick, although different support configurations may have different thicknesses. Vertical supports

100 have a lower end 105A near the sole of the footwear 900 with a wider width that tapers to a narrower width at an upper end 105B proximate to the top of the footwear 900. The inner layer 12 may further comprise a top layer 120 formed from a stretchable fabric material and a bottom layer 128 formed by an elastic material. The bottom layer 128 faces the foot, while the top 120 engages the tensioning members 16 and outer shell. The vertical support members 100 and horizontal support members 102 are positioned between the top layer 120 and bottom layer 128.

#### Article of Footwear with Tensioning Member Channels Over Support Members

FIG. 11 depicts another alternative embodiment of an article of footwear, depicted here as a partial cutaway view of a cleat 1100 that includes support members integrated with an inner layer 1112 and channels such as channel 1140 to guide tensioning members 1130. Inner layer 1112 is positioned inside of an outer shell 1113. Cleat 1100 includes support members 1104 that are similar to the vertical support members 100 seen in FIG. 9-10. As shown in FIG. 11, the cleat 1100 may include one or more channels 1140 formed in the inner layer 1112 to enable movement of one or more of the tensioning members 16 described above. The inner layer 1112 further includes a top layer 1120 and bottom layer 1128. Both the top layer 1120 and bottom layer 1128 are formed from a stretchable materials such as compression fabrics, polypropylenes, webbing, neoprene, elastane, synthetics, and the like. The channel 1140 is stitched into the top layer 1120 of the inner layer 1112. The channel 1140 corresponds to the shape and configuration of one of the tensioning members in the cleat 1100, exemplified by tensioning member 1130. The tensioning member 1130 is arranged over one or more of the support members, such as vertical support 1100, and under the channel 1140 in the top layer 1120. In operation, the channel 1140 enables the tensioning member 1130 to tighten and loosen without interference from the outer shell 1113. Multiple channels such as channel 1140 may also prevent fouling or tangling of different tensioning members in operation. While FIG. 11 depicts a cleat 1100 that includes vertical support members 1100, a similar embodiment may include vertical and horizontal support members as well.

#### Article of Footwear with Adjustable Stabilizing Members

In another alternative footwear embodiment, one or more adjustable stabilizing members are positioned within the footwear to provide additional stability to one or more portions of a foot that is inserted in the footwear. FIG. 12A-FIG. 12E depict an inner layer 1212 of footwear 1200 that includes stabilizing members 1202 that provide stability to portions of the foot. The stabilizing members 1202 and are held in place using one or more tensioning members 1215, embodied here as flexible straps 1208 and 1220A-1220B. The stabilizing members 1202 are repositionable members placed between an inner layer 1212 and outer layer (omitted for clarity) inside of the foot cavity of an article of footwear. Each stabilizing member 1202 is configured to conform to one or more regions of the foot, such as the heel or ankle. One or more of the tensioning members 1215 engages each stabilizing member 1202 to enable the user to adjust the stabilizing member 1202 with respect to a foot in the footwear. One end of each tensioning member 1215 extends outside of the foot cavity and outer shell of the footwear, and may be secured in position after tension is applied. Thus, the user may tighten, loosen, or otherwise adjust the fit of each stabilizing member 1202 to the foot by tightening and loosening a tension member 1215 in a similar manner to the tensioning members 16 described above.

FIG. 12A and FIG. 12B depict an inner layer 1212, heel stabilizing member 1204, and tensioning member 1208, seen here as a tensioning strap. Heel stabilizing member 1204 has a shape that conforms to the heel 1260 of a foot placed in the inner layer 1212, and the stabilizing member 1204 is positioned behind the heel. The heel stabilizing member 1204 has a U-shaped configuration with a lower end 1206 positioned at the base of the heel 1260 and two upper ends 1207A and 1207B that extend toward the ankle. Alternative configurations of the heel stabilizing member 1204 may include different shapes that provide stability to the heel 1260. The lower end 1206 is affixed to the inner layer 1212. The upper ends 1207A and 1207B engage the tensioning member 1208 around the lateral and medial sides of the posterior of the heel 1260. The tensioning member 1208 may be fixedly attached to the upper ends 1207A and 1207B of the stabilizing member 1204, or may thread through openings formed in the upper ends 1207A and 1207B of the stabilizing member 1204.

The tensioning member 1208 includes one end 1232 that is attached to the inner layer 1212 under the sole of the foot. The length of the tensioning member 1208 may be fixedly attached or threaded through the ends 1207A and 1207B of the stabilizing member 1204. A second end of the tensioning member 1236 may end in a tension adjustment member, such as a tab or other attachment device that is configured to engage a fastening pad or other fastening mechanism positioned on the outside of the footwear in a similar manner to the embodiments of FIG. 1A-FIG. 8.

FIG. 12C-FIG. 12E depict two ankle stabilizing members 1216A and 1216B that conform to the medial side and lateral side, respectively, of an ankle. Both of the ankle stabilizing members 1216A and 1216B are formed with a U-shape. As seen in FIG. 12C and FIG. 12D, a curved end 1217A of the U-shaped stabilizing member 1216A is positioned to engage the posterior side of the medial malleolus 1218A. The curved end 1217A is affixed to the inner layer 1212. The open ends 1219A and 1219B of the stabilizing member 1216A extend above and below the medial malleolus, respectively, toward the anterior of the foot. The end 1219A of the ankle stabilizing member 1216A engages one end of a tensioning member 1220A. The tensioning member 1220A has a length that extends outside of the article of footwear to a second end. The user may pull on the second end of the tensioning member 1220A or on a tension adjustment member affixed thereto in order to adjust the ankle stabilizing member 1216A. The end 1219B of the ankle stabilizing member 1216A engages a strap 1207 that is affixed to the lateral side of the inner layer 1212.

As seen in FIG. 12C and FIG. 12E, a curved end 1217B of the U-shaped ankle stabilizing member 1216B is positioned to engage the posterior side of the lateral malleolus 1218B. The curved end 1217B is affixed to the inner layer 1212. The open ends 1221A and 1221B of the stabilizing member 1216B extend above and below the lateral malleolus, respectively, toward the anterior of the foot. The end 1221A of the ankle stabilizing member 1216A engages one end of a tensioning member 1220B. The tensioning member 1220B has a length that extends outside of the article of footwear to a second end. The user may pull on the second end of the tensioning member 1220B or on a tension adjustment member affixed thereto in order to adjust the ankle stabilizing member 1216B. The end 1221B of the ankle stabilizing member 1216B engages a strap 1205 that is affixed to the medial side of the inner layer 1212.

In a finished article of footwear, an outer shell, omitted in FIG. 12A-FIG. 12E for clarity, encloses the stabilizing

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members **1204**, **1216A** and **1216B**. The stabilizing members **1204**, **1216A**, and **1216B** are not directly attached to the outer shell to enable adjustment of the semi-rigid members. The stabilizing members **1204**, **1216A**, and **1216B** are each formed from one or more semi-rigid materials to enable the stabilizing members to conform to the foot and ankle while resisting ankle rolls and other movements that may cause injuries. As used herein, the term “semi-rigid” refers to a material that resists deformation under stress, but deforms in response to a sufficient force and then returns to an undeformed state when the force is removed. Common examples of semi-rigid materials include polymeric materials such as polyimides and thermoplastics. The stabilizing members depicted in FIG. 12A-12E may be incorporated into any of the footwear embodiments and modifications thereof described in this application.

In operation, a user inserts the foot inside the inner layer **1212** located in the foot cavity to enable the heel **1260** to engage the stabilizing member **1204** and the ankle to engage the stabilizing members **1216A** and **1216B**. The user may first apply a selected tensioning force to the end of the tensioning member **1208** that extends outside of the footwear to draw the stabilizing member **1204** into further engagement with the heel **1260** to provide support to the heel **1260** when wearing the footwear. As described above, the tensioning member **1208** may be tightened or loosened to increase or decrease, respectively, the tightness of the stabilizing member **1204** with respect to the foot. The tensioning member **1208** is secured to an outer shell of the footwear in a similar manner to the embodiments of FIG. 1-FIG. 8 to retain the stabilizing member **1204** in the selected position.

After adjusting the tensioning member **1208** and associated heel stabilizing member **1204**, the user may then adjust the tensioning members **1220A** and **1220B** that engage ankle stabilizing members **1216A** and **1216B**, respectively. To accomplish this, the user applies a selected tensioning force to the ends of tensioning members **1220A** and **1220B** that extend outside of the footwear and secures them to the outer shell to engage the stabilizing members **1216A** and **1216B**, respectively, to the ankle. The foregoing description does not limit the order of adjusting the tensioning members **1215** and stabilization members **1202**. The user may adjust the tensioning members **1208**, **1220A**, and **1220B** and corresponding stabilization members **1204**, **1216A** and **1216B** in any order.

The stabilizing members **1204**, **1216A**, and **1216B** provide additional support to the heel and ankle. The tensioning members **1215** enable a user to adjust the stabilizing members **1202** to conform to the foot and ankle while wearing the footwear. While the foregoing embodiments depict stabilizing members **1202** engaging the heel and ankle regions of the foot, alternative embodiments may have stabilizing members for one of the heel and ankle, and may include similar stabilizing members that engage other areas of the foot.

#### Article of Footwear with a Locking Strap

FIG. 13 illustrates an alternative embodiment of a cleat **90** that includes a locking strap **96** for securing a tensioning strap **92** in place after a user adjusts the tensioning strap to apply compression to a foot inserted into the cleat **90**. Cleat **90** includes tensioning strap **92** positioned in the foot cavity, shown here in a partial cutaway view, that is attached at an attachment point **94** in proximity to the forefoot or midfoot region of the cleat **90**. Cleat **90** also includes a locking strap **96** positioned on an outer shell **95** of the cleat **90**. The locking strap **96** includes a first end that is affixed to the outer shell **95**. The locking strap **96** wraps around the ankle

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region of a foot inserted into the cleat **90**, to surround an end of the tensioning strap **92** or a tensioning member affixed to the end of the tensioning strap **92** that extends out of the outer shell **95**. A second end **97** of the locking strap **96** is configured to be releasably secured to another portion of the locking strap **96** using a hook and loop material. Alternative embodiments may include various other fastening mechanisms that secure the second end **97** of the locking strap **96** in place.

The cleat **90** also includes a toe guard **98**. Toe guard **98** may comprise a material with an increased resistance to compression forces, such as those experienced when a large load is placed thereupon. Such materials exhibit a higher modulus of elasticity and include, but are not limited to, Kevlar fibers, plastics, and the like.

In operation, a user first inserts a foot into cleat **90**. The user then pulls on an end of tensioning strap **92** that extends out of the outer shell **95** to apply a tensile force to the tensioning strap **92**. Such application urges the heel of a foot inserted into the cleat **90** into the heel region **91** of the cleat **90**. The heel region **91** may include an external support member **93** that engages with the posterior end of the heel. The end of the tensioning strap **92** is secured to the outer shell **95** of the cleat **90** using a hook and loop type of engagement (although other known methods may also be used). The user then wraps locking strap **96** around the ankle region of the foot and the end of the tensioning strap **92**. After the locking strap **96** is wrapped around the foot, the user fastens the second end **97** of the locking strap. The locking strap **96** enables the tensioning strap **92** to remain in a position with the tensile force applied after the user tightens the tensioning strap **92**.

#### Article of Footwear with Serially Arranged Tensioning Members

FIG. 14 depicts four views of another embodiment of an article of footwear **1410** that includes tensioning members engaged in series with adjustment tabs. In the embodiment of FIG. 14, a first set of tensioning members **1420A** engage the mid foot region extending from a midfoot flap **1426** on the medial side of the footwear **1410** to a tab **1422** positioned on the medial side of the footwear **1410**. A second set of tensioning members **1420B** extend from the tab **1422** underneath the sole **1418** to another tab **1424** that engages a fastening pad **1440A** on the lateral side of the footwear. In a similar arrangement, a first set of tensioning members **1430A** extend from a flap **1428** on the lateral side of the footwear **1410** and extend to a first tab **1434** that may be secured to a fastening pad **1444**. A second set of tensioning members **1430B** extend from the first tab **1434** around the posterior of the ankle to another tab **1436** that is secured to the fastening pad **1444** on the lateral side of the foot. In the embodiment of FIG. 14, fastening pad **1444** wraps around the posterior of the footwear **1410** to fasten flaps **1434** and **1436** on both the lateral and medial side of the footwear **1410**. An alternative embodiment may include separate fastening pads on the medial and lateral sides. Flaps **1426** and **1428** may overlap each other.

In operation, a user inserts a foot into the footwear **1410**. The user tightens tensioning members **1420A** by pulling on the tab **1422**, and then secures the tab **1422** to a medial fastening pad **1440A**. The user then tightens tensioning members **1420B** by pulling on the tab **1424** and securing the tab **1424** to a lateral fastening pad **1440B**. In a similar manner, the user may adjust tab **1434** first followed by tab **1436** to adjust the tensioning members **1430A** and **1430B**, respectively. The magnitude of compressive force applied to the foot by tensioning members **1420A** and **1430A** may be

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different than the compressive force applied by tensioning members **1420B** and **1430B**, respectively. The configuration of footwear **1410** provides compression to the medial and lateral sides of a foot without a crisscross arrangement of the tensioning members **1430A** and **1430B**.

Article of Footwear with Tensioning Members Affixed to a Strap

FIG. **15** depicts a medial and lateral view of another embodiment of an article of footwear **1510** that includes tensioning members that are attached to a strap. Footwear **1510** includes tensioning members **1520** that are attached to an inner layer **1512** near the heel of the foot. The tensioning members **1520** are attached to one end of a strap **1530** that wraps around the ankle and is configured to be fastened to the footwear **1510** at a location above the ankle. The strap **1530** is attached the tensioning members **1520** at a location between the inner layer **1512** and an outer shell **1513**, with the other end of the strap **1530** extending to the outside of the outer shell **1513**. The strap **1530** has a width that enables each of the tensioning members **1520** to be attached to one end of the strap **1530**. The strap **1530** is positioned within a sleeve **1516** formed outside of the inner layer **1512**. The sleeve **1516** enables the strap **1530** to be tightened and loosened in operation. The strap **1530** may be attached to tensioning members on either the medial or lateral side of the foot, and may wrap around the foot and ankle one or more times.

In operation, a user inserts a foot into the footwear **1510**. The user pulls on the end of the strap **1530** that extends outside of the outer shell **1513**. The tensioning members **1520** apply a compressive force to the heel, and the strap **1520** applies a compressive force to the ankle. The tensioning members **1520** are shown as engaging the heel, but may engage the forefoot and midfoot regions as well.

Article of Footwear with Tensioning Strap and Support Members

FIG. **16** depicts another alternative embodiment of an article of footwear **1610** including tensioning straps and a support member. Article of footwear **1610** has an inner layer **1612**, with a strap **1616** that attached to the lateral side of the inner layer **1612**. The strap **1616** extends over the fore foot region through a D-ring **1618** on the medial side of the footwear **1610**. The strap **1616** extends back to the lateral side of the footwear **1610**, where an end of the strap **1616** may be fastened to the exterior of the footwear **1610**. A second strap **1622** includes one end attached to the upper edge of the sole **1620** around the forefoot, midfoot, and heel portions of the sole **1622**. Strap **1622** extends around the upper foot and wraps around the ankle in the footwear **1610**. The strap **1622** includes one end **1624** that extends outside of an outer shell of the footwear **1610** to enable tightening and loosening of the strap **1620**.

Footwear **1610** includes one or more pockets **1628** formed in the inner layer **1612**. A support member, embodied herein as a nylon support member **1632** is positioned within the pocket **1628**. The pocket **1628** is configured to enable the support member **1632** to move within the pocket **1628**. In the example of FIG. **16**, the pocket **1628** is configured with a length and a width that are 6 mm larger than the corresponding length and width of the support member **1632**. Strap **1622** wraps around the pocket **1628** and support member **1632**.

In operation, a user inserts a foot into the footwear **1610**. The user may pull on straps **1616** and **1622** to apply compression to the forefoot, midfoot, heel, and ankle regions of the foot. Tension may be applied to the straps **1616** and **1622** in any order. The support member **1632** may

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move within the pocket **1628** to provide support to the foot in different orientations when wearing the footwear **1610**.

Article of Footwear with Tensioning Strap Wrapped Around Foot

FIG. **17** depicts another alternative embodiment of an article of footwear **1710** including a tensioning strap **1720** that is configured to pass under the foot and around the ankle. Tensioning strap **1720** is attached to an inner layer **1712** of the footwear at a midfoot location **1724** on the lateral side of the footwear **1710**. The tensioning strap **1720** extends horizontally along the lateral side of the footwear **1710**, wraps around the medial side of the footwear **1710**, and returns to the midfoot region on the lateral side of the footwear **1710**. The tensioning strap **1720** further extends down the lateral side of the footwear **1710**, under the foot, and extends up the medial side of the footwear **1710** where an end **1730** is positioned outside of an outer shell of the footwear **1710**. The end **1730** may be fastened to the outer shell of the footwear **1710**.

In operation, a user inserts a foot into the footwear **1710**. The user may pull on the strap **1720** to apply compression to the midfoot and ankle regions of the foot. In the embodiment of FIG. **17**, a single strap **1720** applies compression to both the medial and lateral sides of the foot. While the strap **1720** is depicted as being attached to the lateral side of the footwear **1710** and extending through the medial side of the footwear **1710**, and alternative configuration may arrange a tensioning strap to extend from the medial side to the lateral side.

Article of Footwear with Internal Compression Wrap

FIGS. **18A-18C** depict another alternative embodiment of an article of footwear **1810** including a sole **1815** connected to a shoe upper **1825** (not shown in FIG. **18A**, see FIGS. **18B** and **18C**), and an elastic wrap member **1830** positioned within the foot cavity. In this embodiment, the sole **1815** is provided as a cleat, and the shoe upper **1825** is provided in the form of an athletic boot. The elastic wrap member **1830** is provided as a sheet of stretchable material within the foot cavity which acts as a cradle member to partially surround the foot **1899** of the wearer and provide compression to the foot **1899** of the wearer.

The elastic wrap member **1830** is comprised of an elastic fabric material similar to that commonly found in traditional ankle wraps. The material used to form the elastic wrap member **1830** includes a resilient stretchable component that allows the elastic wrap member **1830** to be stretched around a wearer's foot when tightened within the foot cavity, and then spring back to its original shape when loosened within the foot cavity. Accordingly, the elastic material may be provided as a woven fabric material that includes elastane or other elastic fibers. The elastic material may also include non-elastic fibers or less elastic fibers such as polyester, nylon or cotton fibers.

In the embodiment of FIGS. **18A-18C** the elastic wrap member **1830** is located in an ankle region **1850** of the article of footwear **1810**. In particular, the elastic wrap member **1830** is positioned within the foot cavity such that a lower edge **1832** of the elastic wrap member **1830** is located in a heel region **1852** of the article of footwear **1810**. The elastic wrap member **1830** extends up from the heel region **1852**, over the ankle region **1850**, and to a top edge **1854** of the article of footwear **1810**. Accordingly, the elastic wrap member **1830** at least partially or completely covers the ankle of the wearer when the wearer's foot **1899** is positioned within the article of footwear.

In the embodiment of FIGS. **18A-18C**, the elastic wrap member **1830** includes a generally cradle portion **1840** and

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adjustable edges **1848**. The cradle portion **1840** forms a C-shaped cylindrical member that extends along the interior of the shoe upper **1825**. The cradle portion **1840** includes a main body **1842** that is generally free-floating within the foot cavity and therefore generally separate from the shoe upper **1825**. However, although the main body **1842** is generally separate from the shoe upper **1825**, relatively small sections of the cradle portion **1840** may be fastened to the shoe upper **1825** at various locations, including along a forward seam **1844** that runs along the tongue slot on the shoe upper **1825**. In other embodiments, additional portions of the main body **1842** of the cradle portion **1840** may also be fastened to the shoe upper **1825** in addition to the forward seam **1844**. For example, as best shown in FIG. 18C, the main body **1842** of the cradle portion **1840** may be connected to the shoe upper **1825** along a vertical seam **1846** in the rear of the shoe upper **1825**. These seams **1846**, **1844** that fasten the cradle portion **1840** to the shoe upper **1825** may be provided using any of various means, such as stitching, adhesives, or other fastening means. However, even with the seams **1842**, **1844**, most of the main body **1842** of the cradle portion **1840** remains generally free-floating and moveable relative to the shoe upper **1825**. This includes the portions between the vertical seam **1846** and the forward seam **1844** of the cradle portion **1840**. Because substantial portions of the main body **1842** are free-floating relative to the shoe upper **1825**, the cradle portion **1840** may be tightly wrapped around the foot **1899** of the wearer even if the shoe upper is not as tightly wrapped around the foot **1899**.

The adjustable edges **1848** of the elastic wrap member **1830** are generally connected to the portion of the shoe upper **1825** that includes the shoelace eyelets **1828** for the article of footwear **1810**. Accordingly, the adjustable edges **1848** of the elastic wrap member **1830** may be connected to the shoe upper **1825** along the above-mentioned forward seams **1842**. However, in other embodiments, the adjustable edges **1848** may be coupled to other portions of the shoe upper, such as only the shoelace eyelets **1828**. As shown in FIG. 18A, the adjustable edges **1848** may include tab members **1849** that extend the elastic wrap member **1830** to the shoelace eyelets **1828** on the shoe upper **1825**. In some embodiments, the forward seam **1844** of the cradle portion **1840** does not extend to the shoelace eyelets **1828** on the shoe upper **1825**, but may be fastened to other areas on the shoe upper **1825**. For example, the forward seam **1844** of the cradle portion **1840** may extend along the tongue slot **1829** or other line that follows the eyelets **1828** on the shoe upper **1825**.

As described above, in the embodiment of FIGS. 18A-18C, the elastic wrap member **1830** only partially surrounds the ankle of a wearer from the rear of the ankle (i.e., the Achilles tendon area) to a position forward of the ankle. For added support on the anterior portion of the ankle, the tongue **1890** may be provided as a thick padded member. For example, the tongue **1890** may be a custom molded open cell foam product that is flexible and provides cushioned support on the anterior portion of the foot, as shown in FIG. 8A. In some embodiments, the tongue **1890** may include various surface patterns or other features.

In operation, a wearer inserts his or her foot **1899** into the foot cavity of the article of footwear **1810** and pulls the ends of the shoe laces **1826**. This action draws the shoelace eyelets **1828** and related upper perimeter portions of the shoe upper **1825** together in a traditional fashion. Because the elastic wrap member **1830** is coupled to the shoe upper along the eyelets or other upper perimeter portions, pulling the shoe laces **1826** also pulls the elastic wrap member **1830**

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around the foot **1899** of the wearer, as illustrated by arrows **1833** in FIG. 18A. This results in the elastic wrap member **1830** being drawn to a stretched position as indicated by dotted lines **1831** in FIG. 18A. Accordingly, the elastic wrap member **1830** provides a convenient ankle wrap or other foot wrap that is integrated into the article of footwear **1810** without the need for a separate wrap member.

With particular reference now to FIG. 18B, in at least one embodiment, the outer shell of the shoe upper **1825** includes a non-elastic portion **1870** and an elastic portion **1880**. A seam **1875** may be formed on the article of footwear **1810** where the elastic portion **1880** meets the non-elastic portion **1870** of the shoe upper. The non-elastic portion **1870** is formed from more traditional materials for a shoe upper, such as leather, synthetic leather, or a soft plastic material. The elastic portion **1880** of the shoe upper **1825** comprises an elastic material with resilient qualities, similar to the elastic wrap member **1830**. In at least one embodiment, the elastic portion **1880** is comprised of a foam material adhered to one or more layers of elastic fabric. For example, the elastic portion **1880** may include an open cell foam that is sandwiched between two layers of stretch fabric comprised of elastane or other stretch material.

The non-elastic portion **1870** of the article of footwear is positioned in a midfoot region and a forefoot region of the shoe upper **1825**. The elastic portion **1880** is generally provided on the same portion of the article of footwear **1810** where the elastic wrap member **1830** is located (e.g., the ankle portion **1850**). Because the elastic portion **1880** of the shoe upper **1825** is both flexible and elastic, the elastic portion **1880** is allowed to more closely adhere to the foot **1899** of the wearer when the shoelaces **1826** are tightened on the article of footwear **1810**. Moreover, the combination of the stretched elastic wrap member **1830** and the tightened elastic portion **1880** of the shoe upper **1825** provides the wearer with a tight compression fit. In addition, because the relatively thick elastic portion **1880** of the shoe upper closely adheres to the foot of the wearer, the wearer is also provided with a feeling of additional support and soft flexible bulk than would be felt if only the elastic wrap member **1830** were closely adhered to the foot of the wearer.

Article of Footwear with Flexible Braces in Upper

FIGS. 19A-19F depict another alternative embodiment of an article of footwear **1910** including a sole **1915** connected to a shoe upper **1925** and two brace members **1930**. In this embodiment, the sole **1915** is provided as a cleat, and the shoe upper **1925** is provided in the form of an athletic boot. The two brace members **1930** include a lateral brace member **1932** and a medial brace member **1934**, each of which operates independently of the other.

As best shown in FIGS. 19A and 19D-19F, each brace member **1930** includes a base portion **1940**, a central shaft portion **1950** (which may also be referred to herein as a stem **1950**), and a top plate **1960**, which together form a single integral component (i.e., a unitary component with inseparable sections that are integrally formed). The brace members **1930** may be formed using any of various conventional manufacturing methods, such as injection molding. Each brace member **1930** is comprised of a relatively hard and non-elastic, yet resilient material, such as nylon, or other polymer material. As explained in further detail below, this material allows each brace member **1930** to provide support to the foot **1999** of the wearer, deform when a substantial force is applied to the brace member, and then resiliently return to the original shape when the force is removed. Since each brace member **1932**, **1934** operates independently, each

brace deforms independently, depending on the direction and the amount of force applied.

The base portion 1940 of the brace member 1930 is a plate-like structure with a triangular shape. A flange 1942 is provided near the bottom of the base portion 1940. The flange 1942 is configured to fit under the insole of the article of footwear 1910 to provide a foundation for the brace member 1930. The base portion 1940 extends upward from the flange 1942 to an apex 1944. As best shown in FIG. 19A, the apex 1944 is located at a position above the heel and below the ankle on the foot 1999 of the wearer. An inner face 1946 and an opposing outer face 1948 are defined between the flange 1942 and the apex 1944. The apex 1944 of the base portion 1940 feeds into and merges with the stem 1950.

The stem 1950 of the brace member 1930 is a curved rod-like structure that begins at the apex 1944 of the base portion 1940 and extends rearward and upward toward a dorsal inflection point 1952 located to the rear of the ankle of the wearer. From this inflection point 1952, the stem 1950 extends forward and upward until it feeds into the top plate 1960. Accordingly, the stem 1940 provides a C-shaped rod that curves around the rear of the ankle of the wearer. The stem 1950 is wider at the inflection point 1952 than at other locations on the brace. Thus, as measured in the lateral direction of the foot 1999, the brace member 1930 is widest at the inflection point 1952 of the stem 1950, and gradually tapers upward and downward from the inflection point 1952 to the thinnest areas that merge with the base 1940 and the top plate 1960. While the brace member 1930 is widest in the lateral direction at this inflection point 1952, it will be recognized that the brace member 1930 is deeper at the base 1940 and the top plate 1960 than at the stem 1950 (i.e., the brace 1930 has a greater length in the direction from toe to heel of the foot 1999 at the base 1940 and top plate 1960 than at the stem 1950). As explained in further detail below, this configuration allows the brace member 1930 to bend/pivot in a forward direction (as indicated by arrow 1933 of FIGS. 19A and 19D) about the inflection point 1952.

The top plate 1960 of the brace member 1930 is triangular in shape and includes a curved upper edge 1962, an inner face 1966, and an opposite outer face 1968. The inner face 1966 provides a generally flat support surface that faces the lower leg/foot of the wearer and provides support to the lower leg/foot of the wearer when lateral forces act against the top plate 1960.

With reference now to FIGS. 19B and 19C, the brace members 1930 are configured to fit within closed pockets 1927 in the shoe upper 1925 (see FIGS. 19B and 19C). The pockets 1927 are not open to the foot cavity or the exterior of the article of footwear 1910. Accordingly, the brace members 1930 are embedded between an interior and exterior layers of the shoe upper 1925 where the pockets 1927 are formed. FIG. 19B shows the shoe upper 1925 with the exterior layer 1929 that forms the outside of one of the pockets 1927. FIG. 19C shows the exterior layer 1929 as transparent such that the pocket 1927 is exposed with the brace member 1930 in the pocket. Because the brace members 1930 are completely enclosed within the pockets 1927, the foot 1999 of the wearer is not in direct contact with the brace members 1930. Additionally, the inner walls of the foot cavity may include padding along the pockets 1927 to cushion the foot of the wearer from the relatively hard brace members 1930.

With reference again to FIG. 19A, in an alternative embodiment, the article of footwear 1910 may include support belts 1970. The support belts 1970 are positioned within the support cavity and are comprised of a generally

inelastic woven material, such as a woven polyester or nylon material. One end 1972 of each support belt 1970 is fastened to the top plate 1960 and an opposite end 1974 of the support belt 1970 is coupled to some portion of the upper 1925, such as the eyelets 1928 of the article of footwear 1910. A slot (not shown) may be formed on the inner layer of the shoe upper 1925 that allows the support belt 1970 to extend through the inner layer of the shoe upper and be fastened to the top plate 1960 of the brace member 1930. The support belt 1970 may be fastened to the top plate 1960 using any of various means fastening means, such as adhesives, welding or mechanical fasteners (e.g., rivets, screws, etc.). As shown in FIG. 19A, the support belts 1970 generally extend downward from the top plate 1960 as a narrow strip of material, under the insole (and thus under the foot 1999), and back to a perimeter of the tongue slot 1929 (e.g., to the eyelets 1928). Thus, one end of each support belt 1970 is positioned on the lateral side of the article of footwear 1910, and the opposite side of the support belt is positioned on the medial side of the article of footwear 1910.

In operation, the brace members 1930 prevent unnatural lateral twisting of the ankle, but allow for natural forward pivoting of the ankle (such as that experienced during walking or running). In particular, the C-shaped structure of the stem 1950 allows each brace member 1930 to easily bend forward in the direction of arrow 1933 (see FIGS. 19A and 19D), when the wearer walks or runs. Because the brace members 1930 are separate elements, they may bend together or independently. This forward bending action is primarily experienced at the inflection point 1952, which is the point at which the brace member 1930 is designed to bend. After bending forward, the resilient nature of the brace member 1930 allows the stem 1950 to return to its equilibrium position, as shown in FIG. 19A. Thus, the brace member 1930 has very little impact on the foot 1999 of the wearer during natural running or walking motions.

On the other hand, when the wearer experiences an unnatural twisting of the ankle (causing the brace member 1930 to experience forces in the direction of arrow 1935 of FIG. 19A), the brace member 1930 provides support to the foot of the wearer and helps prevent extreme twisting of the ankle. In particular, when the ankle begins to twist in a lateral or medial direction, the leg of the wearer presses against the top plate 1960. However, the brace member 1930 is not designed to easily bend in the lateral or medial direction. Instead, the brace member 1930 is only designed to easily bend in a forward direction 1933 at the inflection point 1952. The width and shape of the brace member 1930 at the inflection point 1952 means that the brace member 1930 significantly resists lateral bending (in the direction of arrow 1935). This results in an opposing force against the leg of the wearer when the ankle begins to twist. If this opposing force is strong enough, the wearer may avoid or reduce the severity of an ankle sprain from lateral or medial twisting of the ankle.

Although the present invention has been described with respect to certain preferred embodiments, it will be appreciated by those of skill in the art that other implementations and adaptations are possible. Moreover, there are advantages to individual advancements described herein that may be obtained without incorporating other aspects described above. Therefore, the spirit and scope of any appended claims should not be limited to the description of the preferred embodiments contained herein.

What is claimed is:

1. An article of footwear comprising: a sole defining a rearward heel section and a forward toe section of the article

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of footwear; an upper coupled to the sole, the upper defining a foot cavity, and a brace system comprising: a first brace member including an inflection point located at an intermediate location along a length of the brace member, wherein the first brace is configured to bend to a greater degree in a forward direction about the inflection point than at other locations along the length of the brace member, and a second brace member including an inflection point located at an intermediate location along a length of the second brace member, wherein the second brace is configured to bend in a forward direction about the inflection point, wherein the first brace member is configured to bend independently of the second brace member, and wherein each brace is positioned within the heel section and is configured to bend toward the toe section of the article of footwear.

2. The article of footwear of claim 1, wherein:  
the sole defines a medial side and a lateral side;  
the first resilient brace member is disposed on the medial sole side within the heel section; and  
the second resilient brace member is disposed on the lateral sole side within the heel section.

3. The article of footwear of claim 1, wherein each brace member possesses a curvature including the inflection point operable to permit forward flexure of the brace member.

4. The article of footwear of claim 1, wherein:  
the sole possesses a longitudinal dimension and a transverse dimension;  
the brace member moves along the longitudinal dimension of the sole as the brace member moves forward; and  
the brace member resists movement along the sole transverse dimension.

5. The article of footwear of claim 1, wherein a portion of each brace is positioned within the sole.

6. The article of footwear of claim 1, wherein each brace member is formed of a resilient polymer.

7. The article of footwear of claim 1, wherein each brace member forms a single integral component.

8. The article of footwear of claim 7, wherein each brace member is formed of a resilient polymer.

9. The article of footwear of claim 1, wherein each brace member bends about the inflection point from a normal position to a flexed position upon the application of force, and resiliently returning to the normal position once the applied force is removed.

10. The article of footwear of claim 1, wherein each brace member is configured to deform from an original shape upon application of force and return to the original shape when the applied force is removed.

11. An article of footwear comprising: a shoe sole defining a rearward heel section and a forward toe section of the article of footwear; an upper coupled to the sole, the upper defining a foot cavity configured to receive a foot; and a brace system including: a first brace member extending distally from the sole and into the upper, and a second brace member extending distally from the sole and into the upper, wherein, in the distal direction, each brace member extends rearward from the sole to an inflection point, and then extends forward from the inflection point such that each brace member extends from a position below an ankle of the wearer, travels around a dorsal side of the ankle, and extends upward above the ankle, wherein each brace member comprises a resilient polymer material, wherein each brace member is more flexible at the inflection point than at other locations on the brace member, and wherein each brace is positioned within the heel section and is configured to bend toward the toe section of the article of footwear.

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12. The article of footwear of claim 11, wherein:  
the sole defines a medial side and a lateral side;  
the first brace member is disposed on the medial side; and  
the second brace member is disposed on the lateral side.

13. The article of footwear of claim 12, wherein the brace members are oriented on the sole such that the first brace member is positioned directly across from the second brace member.

14. The article of footwear of claim 11, wherein each brace member comprises:

a top portion,  
a bottom portion, and  
a shaft portion oriented between the top portion and the bottom portion.

15. The article of footwear of claim 11, wherein a portion of each brace member is disposed within the sole.

16. The article of footwear of claim 11 wherein each brace member is resilient, bending about the inflection point from a normal position to a flexed position upon the application of force, and resiliently returning to the normal position once the applied force is removed.

17. The article of footwear of claim 11, wherein each brace member is resilient, deforming from an original shape upon application of force and returning to the original shape when the applied force is removed.

18. The article of footwear of claim 11, wherein the article of footwear is an athletic shoe with a cleated sole.

19. The article of footwear of claim 11, wherein the first brace member operates independently of the second brace member.

20. The article of footwear of claim 11, wherein the first brace member is configured to bend independently of the second brace member.

21. The article of footwear of claim 11, wherein each brace member forms a single integral component.

22. An article of footwear comprising: a sole defining a rearward heel section and a forward toe section of the article of footwear, wherein the sole further defines a medial side and a lateral side of the article of footwear; an upper coupled to the sole, the upper defining a foot cavity configured to receive a foot; and a brace system including: a first brace member disposed on the lateral side of the sole, the first brace member extending distally from the sole and into the upper, wherein the first brace member comprises a top portion, a bottom portion, and an arcuate shaft portion oriented between the top portion and the bottom portion, the arcuate shaft portion including an inflection point configured to permit a greater degree of flexure at the arcuate shaft portion than the top portion and the bottom portion of the first brace member, and a second brace member disposed on the medial side of the sole, the second brace member extending distally from the sole and into the upper, wherein the second brace member comprises a top portion, a bottom portion, and an arcuate shaft portion oriented between the top portion and the bottom portion, the arcuate shaft portion including an inflection point configured to permit a greater degree of flexure at the arcuate shaft portion than the top portion and the bottom portion of the second brace member, wherein each brace member forms a single integral component comprising polymer material, wherein each brace member is resilient, deforming from an original shape upon application of force and returning to the original shape when the applied force is removed, and wherein each brace is positioned within the heel section and configured to bend toward the toe section of the article of footwear.

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**23.** The article of footwear of claim **22**, wherein the brace members are oriented on the sole such that the first brace member is positioned directly across from the second brace member.

**24.** The article of footwear of claim **23**, wherein the first brace member is configured to bend independently of the second brace member. 5

**25.** The article of footwear of claim **24**, wherein each brace member forms a single integral component.

**26.** The article of footwear of claim **25**, wherein the arcuate portion is operable to permit forward flexure of the brace member. 10

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